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Employers and the I.E.E.

Status of a graduate

LETTERS which appeared in our "Correspondence" columns recently indicated that some Graduates of the Institution of Electrical Engineers, by reason of their location or the nature of the appointments they obtain, have found great difficulty in making contacts with the necessary number of corporate members to enable them to make application for transfer to the Associate Membership grade. Another complaint was that until the Associate Membership grade was reached, employers were unwilling to make appointments and, in consequence, Graduates failed to obtain positions of sufficient status to bring them into contact with corporate members who could later on, from personal knowledge, support their applications for transfer.

In an editorial comment on this situation made at the time we counselled Graduates who experienced difficulties of this nature to communicate with the secretary of their local Centre, in order that special individual consideration could be given to such cases. Further study of the matter in the light of other communications which have since reached us prompts us to ask whether employers generally are aware that the technical qualifications of a Graduate, as indicated by the examinations set by the Institution, have been for several years the same as those of an Associate Member, with the difference only that Associate Membership provides, in addition, evidence of a certain amount of practical experience.

Recognition of Qualifications

We are inclined to believe that the Graduate does not receive full credit for the qualifications he has attained but is often regarded as just a little better than a student and still unfitted for a post of any responsibility. We think that much could be done to improve the status of a Graduate by the Institution itself and by its indivdual members if they took more active steps to make prospective employers better acquainted with the fact that the Graduate holds the highest qualifications required by the examinations of the Institution and may, in many cases, be regarded as more fitted for an appointment than an Associate Member who, since his examination, may have specialised in one particular line and perhaps become a little rusty in his knowledge in other directions.

In point of fact Graduates do often hold positions involving responsibility, and although such responsibility may not be quite up to the standard or may not have been exercised for the length of time required by the Institution to entitle them to corporate membership, it would still justify their appointment to many executive posts. If, on the other hand, an employer really does need an engineer with some years of experience behind him, he should be able to feel reasonably sure that in engaging an A.M.I.E.E. he will get what he wants. Otherwise he would stipulate that Members only need apply, or else he would ignore Institution qualifications altogether.

What is Responsibility?

As to what does constitute "responsibility" for the purposes of Associate Membership there is room for debate. In a widely diversified industry such as ours, the task of a selection committee in deciding between the comparative importance of the duties of, say, a chief, a head of department and a mere assistant is an unenviable one. Our readers will readily call to mind instances in which responsibility is in the reverse order of that of the nominal positions stated, depending as it does upon the size of the concern and upon the designation that the management may think fit to attach to any particular post.

While nothing should be done that would in any way depreciate the standing of the chartered electrical engineer, it is nevertheless as important that every member should be in his appropriate grade as it is that every qualified electrical engineer should belong to the Institution. Especially is it important that the particular qualifications of every grade—and certainly not least that of the Graduates—should be everywhere fully recognised.

Eastbourne Activities

IN his report for 1937-38 the borough electrical engineer of Eastbourne (Mr. J. K. Brydges) makes a number of references to the rural area which is served by the Corporation's undertaking. The rural consumers represented 14.4 per cent. of the total of 19,857 at the end of March last and they were responsible for 8.3 per cent. of the total sales of 36.8 million kWh. The increase in the amount sold in the rural area was 23.58 per cent. as compared with 1936-37, indicating satisfactory progress, and this resulted in a contribution of £896 to the surplus balance of the undertaking. Another interesting section of the report is that dealing with the installation of equipment owned by consumers which last year represented a large proportion of the appliances connected. For instance, of the total of 189 new cookers 133 were the consumers' own property as were 46 of the 122 water heaters and 153 of the 253 immersion heaters installed. It looks as if the private electrical traders have been doing business there and it seems unfortunate that we had to report last week that the Electricity Committee had recommended the termination of the agreement with the local contractors whereby sales of electrical "fittings" are made through them.

Price Anomalies

ALTHOUGH the differences between electricity tariffs in the areas of the 600 or more supply undertakings may have no basis in reason, comparisons between annual bills for electricity prove little unless all the circumstances, especially load factor, are taken into account. Figures quoted by the Electricity Consumers' Association in the daily Press, relating to a company with 63 substantially similar branches in 50 towns, show that the same amount of money purchases many more kWh in some cases than in others. If the branches are "substantially similar" why these large variations in individual consumptions? If it be that the maximum demand is about the same but electricity is consumed for longer hours, differences in the sizes of the accounts are quite justifiable. Legislation requiring the adoption of a national two-part tariff with a statutory fixed charge and a low running charge, as advocated by the Association, would not and should not equalise the gross payments. Such figures may serve a useful purpose in drawing attention to shortcomings in present methods of electricity supply, but the accompanying conditions must be clearly stated.

Electricity Output

THE rate of increase in electricity generation in Great Britain showed an improvement in July as compared with June, although the advance for the completed portion of the year fell from 6.5 to 6.2 per cent. But as we said a week or two ago, things are not so good in the United States, where output has actually declined. Now we have received a report covering the output of 122 of the principal German stations claiming that the production rose by 14 per cent. in the first six months of this year as compared with the corresponding period of 1937, due, it is said, to the activity of German industry. The output of these stations in June was 2,157.4 million kWh, while that of British stations was 1,612 million kWh.

Alternator Regulation

METHODS in general use for predetermining the inherent regulation of synchronous machines are related in a way that not only makes somewhat clearer the complex effects of varying load and power factors on terminal voltage, but also leads to greater confidence in the use of vectors or vector algebra when predicting the regulation of a machine from figures obtained either from design data or from test results. The prediction of regulation is almost as important as the guarantee of efficiency. The two well-known approximate methods can serve only as a guide to the designer by giving the upper and lower limits of a machine's inherent regulation, while a third more accurate method, which is usually employed, requires careful geometrical construction from the open-circuit and short-circuit characteristics. In this issue Mr. H. Rissik describes another method of construction which is based on reasoning from vector analysis of the three methods referred to. If not as close to accuracy as the third method it has the merit of simplicity, and appears to be more reliable than the two approximate methods.

July Overseas Trade

THE monthly return issued this week by the Board of Trade shows that British electrical exports in July were worth £1,797,811, an increase of £252,264 (16 per cent.) over the corresponding month of last year. The improvement was entirely in the machinery section. Indeed, of the twenty-one sections into which wholly or mainly manufactured goods are classified in the return this is the only one showing an advance, the general reduction being accentuated by the fact that July last year contained one more working day. Electrical imports last month were again low at £338,054—£85,945, or 20 per cent., less than in July, 1937.

The
ELECTRICAL REVIEW
for September 2nd will contain a number of special articles on various aspects of
LIGHTING
written by experts in their particular branches

Seeing is Believing

WHILE the scientific outlook has lost its old dogmatism there is no reason for going to the opposite extreme in adopting a quasi-metaphysical approach to what is, after all, natural knowledge. The tendency of progress is, as Lord Rayleigh said in his presidential address to the British Association this week, to bring the more remote conclusions within the province of direct observation. For example, we can now see the cloud track marked out by an individual atom or its deviation where it collides with another, whereas not many years ago many scientists doubted the material existence of atoms. The human eye had primarily no more than a survival value for the species, but its scope has been extended enormously, largely with the aid of electricity. The eye can now be used to prove or disprove inferences from theories that were originally formulated to fill in the gaps in scientific knowledge.

Science and Warfare

A CONSIDERABLE amount of nonsense contained in popular views about the responsibility of the scientist for increasing "frightfulness" in war was exposed by Lord Rayleigh. Such views are, he showed, delusions due to ignorance of the real course of discovery—an ignorance of the kind that the British Association itself was formed to eradicate. The President had little difficulty in showing that fundamental discoveries which have been adapted to destructive purposes go back much too far in time for them to be controlled at the source. Thus scientists are unable to influence the way in which their labours are used, possibly long after their time on earth. Indeed, the only way in which their benevolent intentions can be realised is in the initiation of a study of the social relations of science. Lord Rayleigh stated that the Association is considering the formation of a division for bringing "the steady light of scientific truth to bear on vexed questions" with a view to promoting international amity. The desirability of such an extension of its activities is surely unquestionable.

Cigarette Manufacture

Electrical production methods and atmosphere control

About four hundred electric motors, totalling 1,600 h.p., are employed in the new cigarette factory just opened by Godfrey Phillips, Ltd., and an elaborate air-conditioning system ensures that the optimum temperature and humidity are maintained throughout every process of manufacture.

A HUNDRED million cigarettes a week! That is the almost unbelievable output of the new factory which Godfrey Phillips, Ltd., have just opened in Commercial Street, London, E.1, to take over their entire production of cigarettes, which includes such well-known brands as "Abdulla," "Greys," "De Reszke," "B.D.V.," &c., not to mention numerous other lines for export. The old factory adjoining is now left free for the manufacture of pipe tobacco and cigars.

So large an output from a factory with 25,000 sq. ft. of floor area has only been possible by making the maximum use of electrically operated equipment. An idea of the extent of the electrical installation is obtained from the fact that no fewer than 400 electric motors of various types and sizes totalling approximately 1,600 h.p. are required for one purpose or another. Almost without exception these were supplied by the Metropolitan - Vickers Electrical Co., Ltd.

Cleanliness and the accurate control of temperature and humidity are of paramount importance throughout the factory, and here, again, electricity plays its part in connection with the elaborate air-conditioning, heating and ventilating plant for which the Sturtevant Engineering Co., Ltd., has been responsible.

Production begins in the stripping and cutting room on the fourth floor at the top of the factory. By means of three Marryat & Scott lifts (two 2-ton and one 5-ton) the raw tobacco is received here in hogsheads each containing 1,000 lb. Three at a time these hogsheads spend 30-40 minutes in what is termed the "Thermo-Vactor" tobacco conditioner. This is, in effect, a vacuum chamber, where, by being subjected to an absolute pressure of 0.1 atmosphere and then having vapour added, the originally compressed, hard and brittle tobacco is given a uniform moisture content to render it soft and pliable enough to handle.

Weighing and blending come next. The blended leaves in wire baskets containing 30 lb. each then travel on a slowly moving roller conveyor (5-h.p. motor) through a 36-ft. long conditioner, where steam is injected to prepare the leaves for stripping or removing the mid-rib. Up to now the leaves have been tied up in bundles or "hands." These are now undone by hand and each leaf fed separately into stripping machines, which grip the stalks in the middle and remove first the bottom portion of the leaves and then the tops. Individual 1-h.p. electric drives are provided on these stripping machines.

After stripping, the leaves are taken by band conveyor to a rotary separator (2-h.p. motor) for sorting out the small and large leaves, a certain amount of the sand and dust contained therein being also collected. The small stuff is sieved and cleaned. An opportunity to pick out by hand any stalks, &c., missed is given while the leaves are passing on the conveyor towards the cutting machines. Magnetised rollers remove any iron or steel impurities.

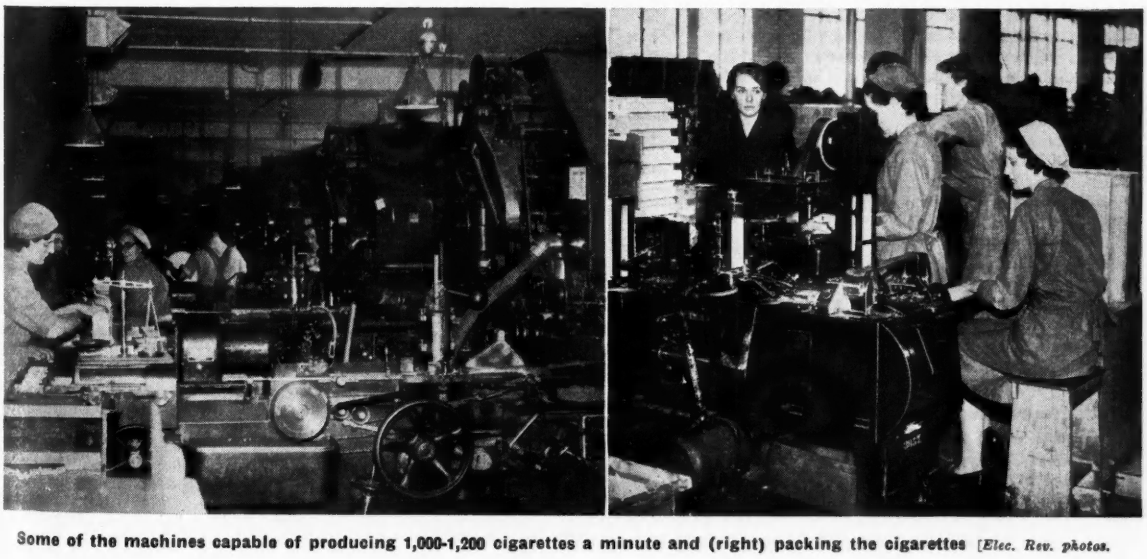
Placing the tobacco leaf in the cutting machines [*Elec. Rev. photo.*

As the tobacco has now become dry and brittle again, it goes through another conditioning machine (5-h.p. motor) in the form of a copper cylinder (which incidentally contains further magnets. Here sprays of hot water increase the moisture content sufficiently for cutting in Molins rotary machines (4-h.p. motors).

Suction plant comprising two main 75-h.p. fans and providing an air flow of 20,000 cu. ft. a minute carries the cut tobacco to a gallery above where long stocking-like devices remove any sand and dust. Four rotary sieves (½-h.p. motors) continue the refining process, the tobacco then being gravity fed into rotary dryers. From here, it is taken by suction to two more rotary sieves and thence by conveyors and chutes to the store room on the floor below.

The chutes deliver the tobacco into boxes holding an average of 165 lb. each and these are stacked three high by means of Matterson hoists. In this room a temperature of up to 80 deg. F. is automatically maintained with provision for varying the relative humidity, which is also automatically controlled. The plant is capable of giving twenty changes per hour with provision for varying the proportion of fresh and return air. A Sturtevant viscous filter is provided for cleansing the incoming fresh air.

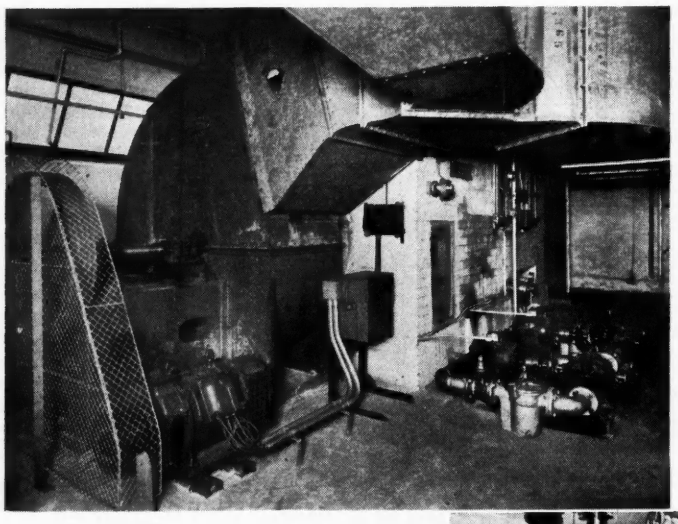
Thus conditioned the tobacco is finally ready for the actual cigarette making, which is carried out by about sixty machines of various types capable of an output of 1,000-1,200 per minute of ordinary cigarettes and 600-800 filter-tipped types. The elec-



Some of the machines capable of producing 1,000-1,200 cigarettes a minute and (right) packing the cigarettes [*Elec. Rev. photos.*

trical equipment of the machines for making the ordinary cigarettes generally comprises a 4-h.p. main driving motor and 1-h.p. subsidiary motor for driving the picker rollers which prepare the tobacco for this final process. The tobacco drops down from the bottom on to a continuous strip of paper, which has just previously been printed with the appropriate wording, and is formed into a cylinder which is automatically gummed, dried and cut to the correct length. The paper is supplied in bobbins sufficient for 12,000 cigarettes. Filter tipped cigarettes are produced in rather a different way. First the filter is inserted in an already formed continuous cylinder of paper. Double-bladed scissors driven by one-third h.p. motors automatically cut the cigarettes to length and the tobacco is then inserted individually in each.

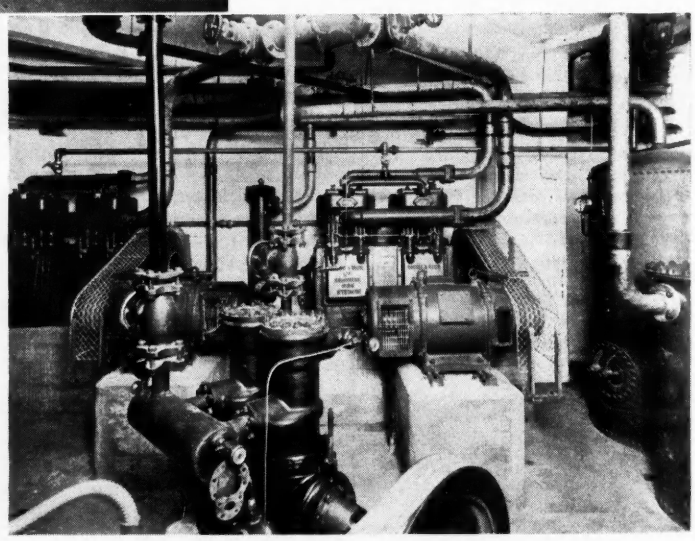
Under summer conditions about 45,000 cu. ft. of filtered air per minute is supplied for the cigarette making room. As in the tobacco store, this is effected by means of the plenum system in conjunction with spray heads, the temperature being automatically maintained at 70 deg. F. and the relative humidity at 65 per cent. Return air ducts enable a large proportion of the air to be recirculated when desirable.



The Strutevant air-conditioning plant serving the cigarette-making department

The cigarettes are then put into drying rooms on the first and third floors, which are served by air-conditioning plant situated on the roof. In this case all fresh air is taken and no provision is made for recirculation.

The hand and machine packing rooms on the first section floors are both treated in much the same way and receive about 40,000 cu. ft. of air a minute. For the packing, either in cartons of ten or twenty or tins of thirty or sixty, machines specially made by Rose Bros. and Molins are employed. These are individually driven by 1-h.p. motors, some geared and some having sprocket drive. The cartons are filled at the rate of about 150 a minute and the tins at about 60 a minute. Machines for wrapping the packets and tins in "Cellophane" at the rate of 220 a minute incorporate small 1- or 2-kW electric heating elements for sealing. Electric heaters are also used in the bundling machines.



Two Broom & Wade compressors each driven by a 45-h.p. motor supplying the spray heads and automatic control gear

When required for export it is usual for the cigarettes to be packed in sealed tins. Equipment for this includes a crimping machine (E. W. Bliss & Co.) driven by a 2-h.p. motor, soldering plant and labelling machines (2-h.p. motors). Gas is used as the heating agent for the soldering, but electric motors are called into service for the mechanical part of the process and for controlling the gas and the air. Electric soldering irons (90-W) put the final touches to tins in vacuum chests to make them air-tight. To remove fumes multivane fans extract from galvanised sheet steel hoods over the machines and soldering benches.

Storing

Ultimately reaching the stock room on the ground floor, the cigarettes are stored at a temperature of 70 deg. F. and in average relative humidity of 65 per cent. The plenum system and spray heads are again used, three air changes per hour being provided. In the despatch department and the stripping and cutting room the temperature is automatically maintained at 70 deg. F. by Sturtevant overhead type fan heater units.

For supplying the spray heads and automatic control gear already mentioned, two Broom & Wade compressors (one acting as a stand-by) have been installed in the basement. Each is driven by a 45-h.p. motor and an after-cooler and an air filter are provided for cooling and cleaning the air delivered. A Sterne two-cylinder Freon compressor belt driven by a 14-h.p. motor supplies refrigeration for chilling the spray water of the air washer used in the Sturtevant plenum installation. Full air conditioning with six air changes an hour is provided in the offices on the ground floor.

One further use of electricity is to be found in the "offal room" situated in the basement of the building. Here the waste tobacco is taken for treatment in the disintegrating plant, which, operated by a 25-h.p. motor, reduces it practically to a powder. For this, provided it contains a certain percentage of tobacco, the Customs and Excise Authorities allow a certain rebate of duty.

The electricity supply for the factory is taken from the Stepney Borough Council at 6,600 V, three-phase. The main circuit-breakers are of the Reyrolle and Met.-Vick. draw-out type with a rupturing capacity of 250,000 kVA. Two 1,000-kVA Met.-Vick. transformers stepping down the supply to 400 V are arranged in parallel and the main switchboard (also Met.-Vick.) is designed so that either of its two halves can be isolated at will.

Special G.E.C. paper-insulated non-bleeding type cable connects the transformers with the switchboard, while Hackbridge armoured cables are used for the main supplies to each floor. The maximum demand at present is about 1,000 kVA. Benjamin industrial type lighting fittings and International Time Recording Co.'s clocks are installed throughout the building.

Our thanks are due to Godfrey Phillips, Ltd., for permission to publish this article and to Mr. D. Mackenzie, the company's chief engineer, and his assistants for their help in compiling these notes.

Gauging the Value of Metal Coatings

THE protective effect of electro-plating is largely dependent on the smoothness of the surface of the metal to be coated, and large quantities of the coating metal are wasted when the surface of the basic metal is rough. The roughness of the surface of the basic metal is determined by its lustre, *i.e.*, by its capacity to reflect light without diffusion. German scientists have now developed an instrument for measuring the lustre of metal surfaces by means of a photo-electric tube, which registers in a curve the diffusion of light reflected from the surface under test. The broader the band recorded by the photo-electric tube, the rougher the surface to be coated and the more plating metal is needed. Substantial quantities of tin are saved in this way in the production of tin cans, without reducing the quality of the cans or their contents.

Leakage Potentials

By T. C. Gilbert, A.M.I.E.E.

Criticism of a recent E.R.A. report

The author considers that the earth-leakage circuit-breaker has not been justly dealt with in a recent E.R.A. report and gives reasons for his opinion

AN investigation into present methods of protecting consumers against leakage potentials is the subject of Technical Report Reference F/T102, entitled "The Safety of Consumers in Rural Areas," issued by the British Electrical and Allied Industries Research Association. It has special reference to solid earthing, protective multiple earthing and earth-leakage circuit-breakers. The Report is emphatic in condemning the first system in all situations where low-resistance electrodes cannot be secured or maintained, thus following all practical experience in that direction, and indicates alternative methods of obtaining safety.

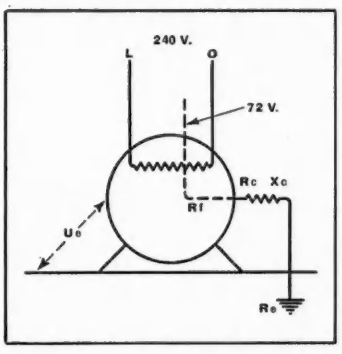


Fig. 1.—Leakage potential with fault 30 per cent. from neutral terminal

A strong case is made out for protective multiple earthing, but this conclusion does not coincide with that reached in other countries, where it has been completely or partly abandoned. The third method, the use of earth-leakage circuit-breakers, has not, in my view, received adequate consideration in the Report. There is no mention of German experience, although over one million of these circuit-breakers are now in use in Germany, subject to firmly established principles. This vast experience should at least have been examined, and if later rejected, the reason could at least have been given. The exclusion of Continental experience robs the Report of its practical value in connection with earth-leakage circuit-breakers.

In addition, exception can be taken to such statements made in the report as the following:—

> "If the tripping current of a switch is 30 mA, its resistance 600 ohms, and a fault occurs on the appliance midway between the two ends of the winding, the switch will trip out if the combined resistance of the fault and the electrode is less than 3,200 ohms. On the other hand, if the tripping current is 60 mA, the impedance 200 ohms, and a fault occurs at a point 30 per cent. away from the neutral terminal the switch will not operate unless the resistance of the fault and the electrode is less than 1,000 ohms. If the resistance exceeds this value, 30 per cent. of the supply voltage, *i.e.*, 72 volts, will be impressed on all the metal work."

Reconstructing these conditions, however, as in fig. 1, we find that where a fault has occurred at a point 30 per cent. away from the neutral, with a resistance of 600 ohms, R_f, the coil resistance is 200 ohms, reactance being neglected, and the earth resistance 400 ohms, R_e, the current flowing is

$$\frac{72}{600+200+400}=60 \text{ mA},$$

which provides the conditions specified. The potential upon the metal work is, however, only 36 V, and not 72 as stated in the Report,

$$\text{since } U_e \text{ (voltage above earth)}=\frac{60}{1{,}000}\times(200+400).$$

As combined fault and electrode resistances amounting to 1,000 ohms are often found in rural areas, the Report is here unfair to the earth-leakage circuit-breaker, for whilst 36 V is within the bounds of safety 72 V is not.

I also quarrel with an important figure in the Report, reproduced here as fig. 2, which purports to show the conditions of operation of earth-leakage circuit-breakers on 240-V supplies. In this, we find trip-coil "impedances" but fault and electrode "resistances," too loose a basis for accurate calculation. The curves should have been worked out on trip-coil resistance and reactance, as the latter has a different effect with high or low electrode resistances; in addition, fault and earth resistances of 16,000 ohms are outside practical politics, and the figure should have been confined to combined resistances between 100 and 5,000 ohms. One coil of 200 ohms operating on 15 mA entails a tripping voltage of only 3 V, and no engineer with practical experience would tolerate a circuit-breaker with a coil impedance of 1,000 ohms as shown at the other end of the scale.

In the ordinates the voltage available to operate the trip is given, whilst with the line "30 volts" an indication of the permissible potential upon connected metal work is shown. In the ordinate, therefore, the fault resistance is included, but in the horizontal 30-V line it is not. In any case, as is clearly shown in the Report, we are not concerned with coil impedances and tripping currents, but only with the response of earth-leakage circuit-breakers to certain voltages against specified electrode resistances.

For correct results I suggest that tripping current should be ignored, and the voltage across the coil, shown in fig. 3 as U, considered. The voltage above earth of metal frameworks, required to operate the circuit breaker can then be ascertained as

$$U_e=U\sqrt{\frac{X_c^2+(R_c+R_e)^2}{X_c^2+R_c^2}}$$

in which X_c is the coil reactance, R_c the coil resistance, and R_e the electrode resistance. For example, if R_c and X_c are 200 ohms, and the value of U is 15 V, then a characteristic of the switch can be obtained, shown in curve 1 of fig. 4; from this it appears that the switch will operate with 30 V framework potential against 330 ohms electrode resistance, a fair value for rural electrodes. For another switch, with R_c and X_c 300 ohms, and with U 15 V, operation is ensured at 30 V against an electrode resistance of 500 ohms (curve 2).

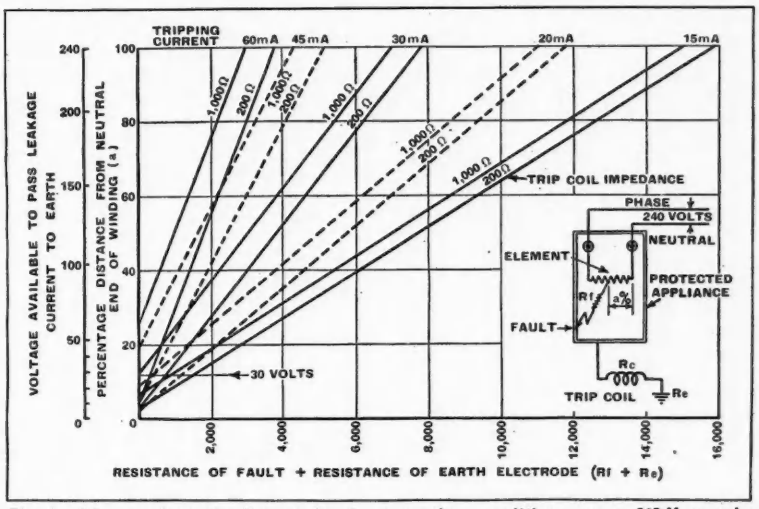


Fig. 2.—Diagram from the Report showing operation conditions on a 240-V supply
Switches will trip if point of intersection of ordinate and abscissa falls above the appropriate line; they will not trip if it falls below

In the majority of earth-leakage breakers available in this country the impedance of the trip coils is far too high, due to attempts to obtain as low an operating current as possible, but resulting in undue voltage rise before operation and the construction of an extremely delicate coil winding that cannot stand up to common use. In samples tested, the reactance may be seven or eight times the resistance, whereas in the standard German device the two are about equal.

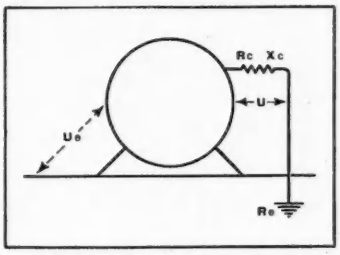


Fig. 3.—Simplification of fig. 2

In the formula which I have given above, the resistance of the fault does not appear, as I consider that it has no bearing upon the limitation of leakage potentials upon connected metal frames; it has a definite bearing upon the question of isolation of the affected equipment or circuit.

The figure from the Report included here as fig. 2, with its

associated diagram in the bottom right-hand corner, provides the only instance in the whole Report where the fault resistance factor has been taken into account, in detail, as it concerns the question of isolation of faulty apparatus or circuits. With solid earthing and protective multiple earthing, in both of which isolation is dependent upon fuse blowing, fault resistance is of the greatest moment, ranking almost in importance with electrode resistance. Even three or four ohms resistance at a fault point, easily provided when an earth fault takes place at some point in a motor winding or a heating element, may prevent isolation of the fault, whereas with earth-leakage circuit-breakers fault and electrode resistances up to 4,000 ohms do not affect isolation.

Taking as an example the conditions indicated in fig. 5, in which the supply voltage of 230 is passed through a 10-A fuse

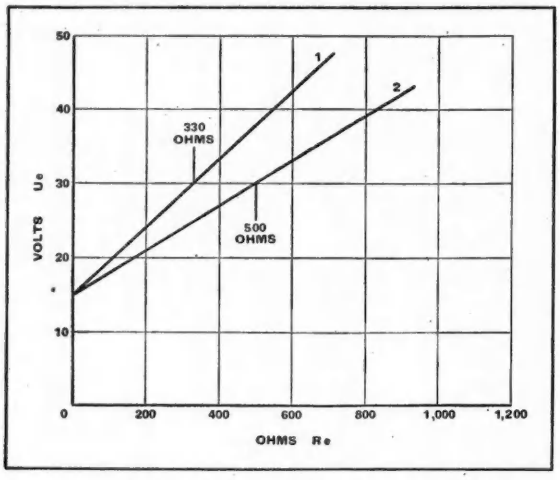


Fig. 4.—Operating voltages with different electrode resistances (1) R_e=200 ohms, X_e=200 ohms, U=15 V. (2) R_e=300 ohms, X_e=300 ohms, U=15 V

to a 15-ohm fault in a motor winding, the sub-station earth resistance being 5 ohms and the consumer's electrode 10 ohms, both very optimistic values: with solid earthing the fault current flowing would be 230/5+10+15=7.7 A, a value insufficient to blow the fuse; the potential remaining upon the metal framework is, however, 77 V, over double that visualised in the Report as safe. With protective multiple earthing, in which the resistance of the earth-neutral has been taken as about 2 ohms in the Report, the fault current might reach 13.5 A, still insufficient to isolate the motor; the frame potential is, however, 27 V, a rather dangerous value if there are cattle about. On the other hand, a 15-ohm fault would have no effect whatever if an earth-leakage breaker were used for the leakage protection of the motor, isolation being immediate; as, moreover, motors are often grossly over-fused where direct-on-line starters are used, it is easy to see where safety lies.

As a member of the sub-committee responsible for the Report—although opposed to its premature publication—I pressed for the inclusion of practical tests on earth-leakage circuit-breakers, hoping that some countenance would be given to established Continental practice. All that could be secured, however, was a series of tests carried out on some thirty-six devices, of unspecified manufacture, and representative of the only area in this country in which earth-leakage circuit-breakers had been installed in any quantity. The voltages listed as required to operate them would, if taken as a guide, prevent extensive use of the earth-leakage breaker here.

Voltage Limitation

The only requirement ever issued in this country, however, in connection with earth-leakage circuit-breakers has been that they should operate with a current not exceeding 30 mA (I.E.E. Regulation 1005 C.). Manufacturers have therefore not been unduly concerned with voltage limitation, and in order to ensure certainty of working have permitted the inclusion of high-impedance trip coils, the result of which is reflected in the high-voltage figures.

The Continental engineer demands apparatus that will operate at about 22 V against an electrode resistance of 200 ohms. Instances are given in the Report of leakage trips that require 80 to 100 V against earth resistances of this value, but the reader is left to infer that such voltage of operation is inherent in the system. It is true that the test results are qualified by the statement that "a number of the switches were of an early type and with the improved switches now available and the development of technique there is good reason to expect better results in the future," nevertheless all relevant facts should be at the disposal of the rural engineer.

Although the high operating voltages listed cannot be justified on any grounds, the equipment has apparently given every satisfaction, in spite of defects in design of some types indicated by the tests. The engineer in whose area the tested switches are installed has reported that the cooker trip switches have required negligible maintenance. Of the several hundred on circuit, some of which have been out three years, only three or four have required attention due to slight mechanical defects. In no instance has any erratic electrical operation occurred. In all cases which have come to his notice of faults to earth on cooker elements and kettle elements, the switches have tripped correctly. Consumers have no difficulty with them, but use them as the main cooker control switch. His experience is that this form of protection is cheap, reliable and effective.

One other point should be dealt with. In the Report five "disadvantages" of the earth-leakage circuit-breaker are set out, one of which reads as follows:—"The test key does not test the continuity of the wiring between the switch and the appliance, but this may be done by momentarily connecting the live side of the supply to the appliance framework, when the switch should operate."

Simple Testing Method

I have always regarded the ability to test the continuity of the earth wire to the electrode by means of the test key, and the complete earth circuit by means of a simple short-over of the phase to the earth terminal or frame of an appliance, as an outstanding advantage of the earth-leakage circuit-breaker, comparable almost with its ability to afford protection against high earth resistances.

One further alleged "disadvantage" is that "if the resistance of the human body is comparable with that of the earth resistance of the leakage switch, and the current through the trip coil is insufficient to operate it, an unpleasant, and in exceptional cases dangerous, shock may be received from the live metal work." This conclusion is, of course, the obvious outcome of thinking in terms of operating currents; the fact is that the human body, placed as it is in parallel with the earth leakage circuit-breaker, can be exposed only to the potential applied to the circuit-breaker. As soon as the requisite potential is reached, whether this be 10 or 30 V, the switch will operate; if any higher potential is necessary to cause the switch to function, it will be by reason of low earth conductivity, and the human body in parallel with the switch is exposed to the same increase in resistance.

The value of the Report would have been considerably enhanced, in my opinion, had the three protective systems been compared on a basis of equality as regards fault resistance and permissible framework potential, as recommended by Dr. O. Lobl in the simple formula R_e=Permissible potential/Fusing current. By using this, the efficiency of protection is rendered independent of (a) the earth-neutral resistance; (b)

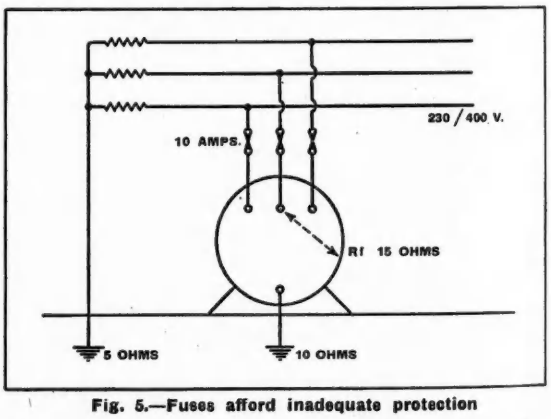


Fig. 5.—Fuses afford inadequate protection

the reactance of the circuit; and (c) the fault resistance R_f—that is, independent of the total impedance of the fault current circuit—and a much truer comparison of the three systems is made. This method also proves that the variable resistance factor effectively disposes of both earthing and protective multiple earthing as a real solution to the rural problem. The substitution of oversize fuses for those of correct rating vitiates many of the calculations in the Report, and this must be considered in any examination of practical conditions.

Absolute control over leakage potentials can only be secured in the logical way—that is, by the installation of protective devices responsive to predetermined potentials, and independent of any factor such as over-fusing. That the Report does not, in my opinion, give this promising system a fair showing is my reason for my criticism of the Report, which is otherwise full of valuable and reasoned information.

Alternator Performance. By H. Rissik

The inherent regulation of synchronous machines and its predetermination

THE regulation of an alternator or transformer is defined as the percentage rise in terminal voltage occurring when full load is thrown off, the excitation (or the applied voltage, in the case of a transformer) being such as to give the normal terminal voltage at full load. In the case of the transformer the secondary load current and its counterpart, the current taken by the primary winding from the a.c. supply, give rise to considerable magnetic leakage. The leakage fluxes in turn produce reactive voltages which, together with the ohmic pressure drops occurring in the resistances of the transformer windings, account fully for the numerical difference between the full-load terminal voltage and the open-circuit e.m.f. Moreover, as the resistance and leakage inductance of a transformer are readily calculable from design or test data, and both remain sensibly constant under all conditions of load, the inherent regulation can be predicted with considerable accuracy.

Besides the usual methods of prediction the author describes one of comparative simplicity which, although not as close to accuracy as that due to Potier, is more reliable than the two well-known approximate methods

The alternator is only a mechanised transformer. In the static transformer the fixed primary winding, across which is applied an alternating voltage of constant r.m.s. value, produces in the magnetic circuit of the apparatus an alternating flux which is more or less completely linked by the secondary winding, also fixed.* In the synchronous a.c. generator the primary winding (rotor), across which is applied a unidirectional voltage of variable value, revolves at synchronous speed and thus produces a rotating magnetic field nearly all of whose lines of force cut across the conductors of the secondary winding (stator).

As producers of alternating voltage the two are similar, but there is an essential difference in the characteristic way in which the load current carried by the secondary winding reacts upon the supply to the primary winding. Such reaction manifests itself in the transformer as an opposition of primary and secondary ampere-turns maintaining an even balance at all loads, except for the small and appreciably constant difference represented by the requisite magnetising ampere-turns. A similar reaction occurs in the alternator, but the balance is destroyed by the complete independence of the respective fluxes produced by the secondary and primary ampere-turns.

The magnetic field of the stator, arising from the action of the armature load ampere-turns, is a revolving field (except in the case of single-phase machines, where the field is an alternating one) produced by the polyphase currents flowing in the armature windings, and thus rotates in perfect synchronism with that of the rotor. This synchronism leads immediately to two important results, the one physical and the other conventional. First, two magnetic fields whose relative position in space is fixed must have a common resultant, the magnitude and orientation of which are determined by the relative strengths and directions of the two component fields. In consequence, the resultant rotor ampere-turns or m.m.f., and thus the induced e.m.f. of the machine, depend directly upon both the magnitude and phase of the stator currents; that is to say, upon the magnitude and power factor of the load. Secondly, this phenomenon of armature reaction, as it is called, can be studied by means of ordinary vector diagrams.*

Unlike the transformer, therefore, the alternator is susceptible to a twofold influence of the external load conditions upon the terminal voltage. On the one hand, armature reaction results in a numerical difference between the open-circuit e.m.f. and the equivalent e.m.f. under load conditions. On the other hand, the combined effects of armature resistance and leakage reactance give rise to a further difference in value between this equivalent induced e.m.f. and the terminal voltage of the machine under load. This characteristic dual influence of the load conditions on the inherent regulation of an alternator is shown by the vector diagram of fig. 1 (a). Here I represents the load current lagging on the terminal voltage V by the power-factor angle ϕ. As the armature winding has a certain resistance as well as appreciable self-inductance, this load current produces an ohmic voltage drop IR in phase with itself, together with a reactive voltage drop IX_o opposing the aggregate e.m.f. of self-induction E_{xo} due to the leakage fluxes in the slots and in the overhang space. These fluxes are in phase with the current and may conveniently be lumped together as the armature leakage flux represented by Φ_o. The induced e.m.f. E of the loaded alternator is thus given by the vector sum of the terminal voltage V and the impedance drop IZ_o, and it leads the load current I by the internal phase angle ψ. If z be this impedance drop expressed as a fraction of the terminal voltage (*i.e.*, $z=IZ_o/V$) then $E=V\sqrt{[1+Z^2+2z\cos(\phi_o-\phi)]}$, where $\phi_o=\tan^{-1}(X_o/R)$.

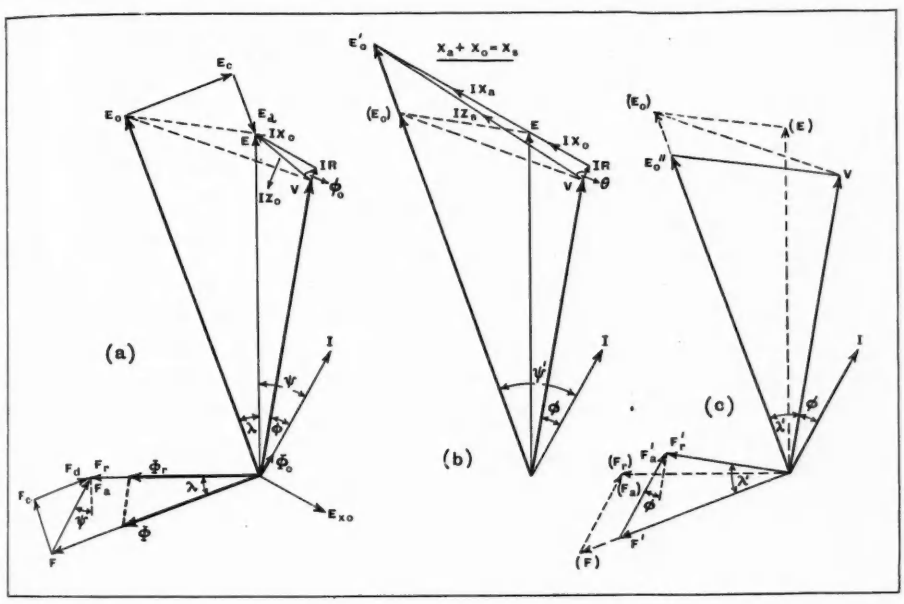


Fig. 1

The induced e.m.f. E under load conditions is generated by the main flux Φ_r which leads it by 90 electrical degrees as shown. This flux is in phase with the resultant rotor m.m.f. or ampere-turns F_r producing it. This resultant m.m.f. arises from the reaction of the armature m.m.f. F_a due to, and thus in phase with, the load current I, upon the m.m.f. due to the rotor pole excitation. The latter is consequently represented by F, whose magnitude and direction is such that the vectorial subtraction from it of the armature reaction m.m.f. F_a gives the required rotor m.m.f. F_r. In the case of a lagging load current, as shown in fig. 1 (a), the armature reaction m.m.f. F_a has two components, the so-called cross-magnetising and direct-magnetising m.m.f.s, F_c and F_d, the former being purely distorting and therefore torque-producing, and the latter being

*The secondary winding need not be fixed. The induction regulator is merely a transformer having a movable secondary winding. Again, the induction motor is simply a transformer whose secondary winding is free to rotate. Both are examples of the general transformer, of which the static transformer is only a special case.

*The assumption made here is that the m.m.f. distribution around the periphery of the armature and the resulting flux distribution in the air gap are both sinusoidal. This assumption would seem to be justified for turbo-alternators, but hardly for salient-pole machines. For this reason it is less easy to predict the effect of armature reaction upon the terminal voltage in alternators of the latter type.

demagnetising or field-weakening in its effect. As the result, the rotor m.m.f. F_r is less than the actual m.m.f. F due to the rotor pole excitation acting alone, whilst the axis of the main flux Φ_r lags behind the axis of the rotor poles by the torque angle λ.

Under no-load conditions the effect of armature reaction is absent so that the main flux increases to the value Φ, being determined by, and in phase with, the actual exciting ampere-turns or m.m.f. F. The open-circuit e.m.f. of the machine is thus E_o, lagging 90 electrical degrees behind Φ, and thus leading the e.m.f. E induced under load conditions by the same torque angle λ. There is, however, no strict proportionality between the changes in magnitude of m.m.f. and flux or e.m.f. Owing to the variable permeability of the magnetic circuit of the machine the change from E to E_o, produced by, and proportional to, the change from Φ_r to Φ, is proportionally less than the corresponding change from F_r to F to which it is due. For with increasing magnetic saturation the drop in e.m.f. E_d due to the demagnetising component F_d of the armature reaction m.m.f. becomes less pronounced, whilst the cross-magnetising effect represented by the voltage drop E_c is almost fully maintained.

Referring to fig. 1, (a), the inherent regulation of the alternator is given by $r=\frac{E_o-V}{V}\times 100$, where (E_o-V) is the numerical, not the vector, difference between the open-circuit e.m.f. and the full-load terminal voltage. Two approximate methods of arriving indirectly at the value of r for given values of load current and power factor are commonly employed for large alternators where it would be impracticable to carry out a direct load test. The relationship of these two experimental methods to the complete alternator vector diagram of fig. 1 (a) both explains the results obtained in practice and provides a numerical verification of such methods of predetermining the inherent regulation.

Synchronous Impedance Method

The first of these approximations, due to Behn-Eschenburg,* and commonly termed the synchronous impedance method, is illustrated by the vector diagram of fig. 1 (b). It is similar to the method devised by Kapp† for transformers, on which the Kapp regulation diagram is based. Behn-Eschenburg's method neglects the effect of armature reaction and assumes the alternator to possess constant resistance and self-inductance whose combined effect appears as an impedance-voltage drop accounting for the whole difference between the open-circuit e.m.f. and the full-load terminal voltage. The equivalent impedance producing this voltage drop is termed the synchronous impedance to indicate that it refers to working conditions, and is denoted by Z_s. It is defined as the ratio of the open-circuit e.m.f. E_o to the short-circuit current I_{sc} for the same value of field excitation and its value is readily obtained from the open-circuit and short-circuit characteristics. The particular value of Z_s used in determining the regulation is generally that corresponding to the field excitation giving normal voltage on open circuit. The "synchronous reactance," $X_s=\sqrt{(Z_s^2-R^2)}$, is accordingly looked upon as a composite quantity having the nature of a true reactance, and made up of the armature leakage reactance X_a and an equivalent magnetising reactance X_a.

Referring to fig. 1 (b), this method of predicting the inherent regulation identifies the e.m.f. induced under load conditions with the open circuit e.m.f. In other words, as the effect of armature reaction is replaced by that of the magnetising reactance X_a, the addition of the resistance drop IR and of the reactance drops IX_a and IX_a to the terminal voltage V gives an open-circuit e.m.f. E'_o, represented by a continuation of the vector E_o terminating on the "reactance line" joining the ends of the vectors E and V. In consequence of this, the value of the open-circuit e.m.f. given by the Behn-Eschenburg method of approximation is bound to be in excess of the true value. This conclusion is in accord with actual experience, for the method has long been known to give regulation values considerably in excess of the true values determined from actual load tests; hence it is commonly called the "pessimistic" method. From the trigonometry, of fig. 1 (b) the open-circuit e.m.f. is given by $E_o'=V\sqrt{[1+k^2+2k\cos(\theta-\phi)]}$, where $k=IZ_s/V$ and $\theta=\cos^{-1}(R/Z_s)$. In practice, the correct value of R is determined from the stator copper losses obtained in the short-circuit test.

Ampere-turn Method

The second of these methods of approximation, due to Rothert,*, and generally referred to as the ampere-turn method, shown in fig. 1 (c), neglects the armature leakage fluxes and assumes that the difference between the open-circuit e.m.f. and the full-load terminal voltage is wholly due to the effect of armature reaction. According to this assumption it is the terminal voltage V which is regarded as being generated by a flux due to the resultant rotor ampere-turns or m.m.f. F_r' which latter can thus be obtained directly from the open-circuit characteristic. Rothert's method further assumes that this resultant m.m.f. is the vector difference of the m.m.f. F', due to the rotor pole excitation acting alone, and the armature reaction m.m.f. F_a'. The latter is in phase with the load current I and thus makes the angle $(90°+\phi)$ with F_r' as shown in the diagram. The magnitude of F_a' is determined by the further assumption that under short-circuit conditions the entire field excitation of the machine is utilised in overcoming armature reaction. Hence in Rothert's vector construction F_a' is taken to be that value of exciting ampere-turns or m.m.f. necessary to produce a short-circuit current equal to the load current I, and its value is thus directly obtained from the short-circuit characteristic. The vector F' representing the m.m.f. due to the rotor pole excitation acting alone is then simply the vector sum of F_a' and F_r', and is thereby determined both in magnitude and in phase. The no-load flux produced by, and in phase with this latter m.m.f. is taken to be that generating the open-circuit e.m.f. E_o'', lagging 90 electrical degrees behind it, whose value is obtained from the open-circuit characteristic. For E_o'' is simply the open-circuit e.m.f. corresponding to the field excitation represented by the vector F'.

From fig. 1 (c) it is seen that this method of predicting the

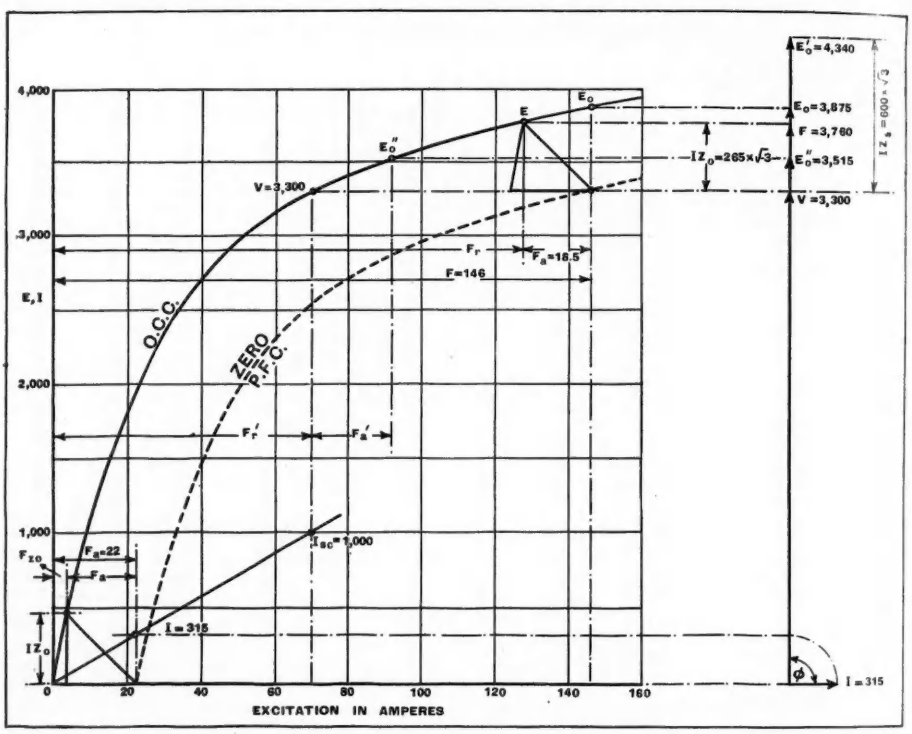


Fig. 2

* *The Electrician*, 1895, Vol. 35, p. 424.

† *Elektrotechnische Zeitschrift*, 1895, Vol. 16, p. 260.

* *Elektrotechnische Zeitschrift*, 1899, Vol. 20, p. 619.

inherent regulation identifies the e.m.f. induced under load conditions (represented by the vector E in all three diagrams of fig. 1) with the full-load terminal voltage. In other words, both the open-circuit e.m.f. vector E_o'' and the terminal voltage vector V terminate on the straight line parallel to the imaginary vector representing the actual voltage drop due to armature reaction. In consequence of this the value of the open-circuit e.m.f. given by the Rothert method of approximation is bound to be less than the true value. Here, again, the conclusion drawn from considerations of vector analysis are in accord with actual experience, for this method has always been found to give regulation values below the true values given by actual load tests and is therefore often known as the "optimistic" method.

The relationship between the above two methods of approximation and the alternator vector diagram is made clearer by reference to an actual example. Fig. 2 shows the open-circuit and short-circuit characteristics of a 3,300-V, three-phase, star-connected turbo-alternator designed for a full-load output of 1,500 kW at 0.8 p.f. lagging. The effective armature resistance proved to be 0.09 ohms per phase, while the excitation required to give normal voltage at full load and approximately zero power factor was 146 A.

Fischer-Hinnen's construction* for separating the effects of armature reactance and reaction is also indicated in fig. 2, the zero-power-factor characteristic being shown dotted. The construction gives for the full-load "leakage" impedance drop IZ_o=265 V per phase, the corresponding excitation needed to circulate full-load current through this impedance being F_{zo}=3.5 A. From the short-circuit characteristic the excitation corresponding to full-load current (I=315) is F_a'=22 A, so that the true armature reaction m.m.f. is represented by an excitation F_a=(F_a'−F_{zo})=18.5 A. From the o.c.c. and s.c.c. the synchronous impedance is found to be 1.9 ohms per phase, giving a full-load "total" impedance drop of 600 V per phase, or 1,040 V at the terminals As shown by the vector diagram be E=V×1.10=3,630 V. On drawing a parallel to the closing vector V-E_o'' (as shown in fig. 1 (c)) the value E_o=3,720 V is found for what should be the true open-circuit e.m.f. The correctness of this new construction is shown by completing the "armature reaction" part of the vector diagram of fig. 1 (a)* with F_r=106 A (corresponding to E=3,630), F_a=18.5 A (from fig. 2) and

$$\psi=\tan^{-1}\left(\frac{V\sin\phi+IX_o}{V\cos\phi+IR}\right)=42°.2,$$

which gives an excitation F= 119 A, and thus E_o=3,720 V as the true open-circuit e.m.f. The correct value for the regulation is thereby determined as r=12.7 per cent.

To facilitate comparison of the above methods of predetermining the regulation the various results are summarised in the following table:—

Method.	cosϕ=0.8	cosϕ=0.
Behn-Eschenburg... ...	23.0%	31.5%
Rothert	5.3%	6.5%
Potier	12.7%	17.5%

Fourth Method

Since as a rule the leakage reactance X_o may be estimated with considerable accuracy from design data, and a zero-power-factor load test cannot always be conveniently carried out, in order to obtain the values of X_o and F_a necessary to construct the complete vector diagram of fig. 1 (a), the construction outlined in fig. 1 (c) can be used to arrive at the regulation more accurately than by means of the synchronous impedance or ampere-turn methods of simple approximation. With X_o known (from design figures) and R determined from a short-circuit test, E can readily be found. Rothert's method can then be used to find E_o''. Finally, E_o is found by drawing EE_o parallel to VE_o''. While this relatively simple method

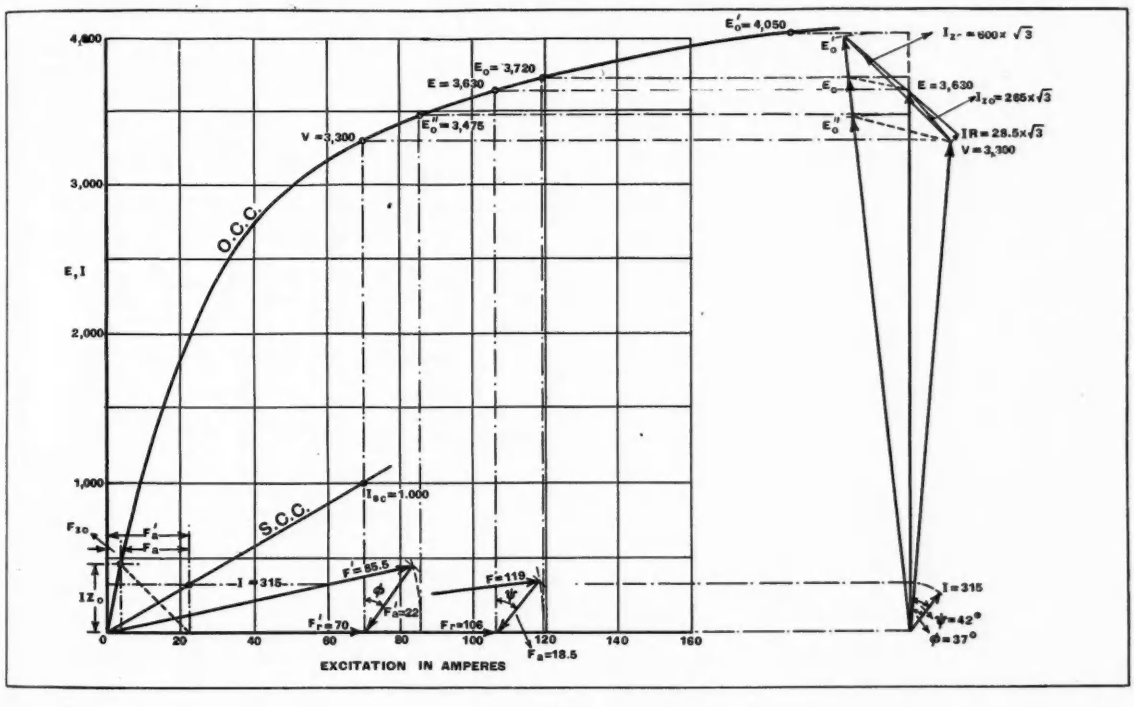


Fig. 3

for cosϕ=o, at the right of fig. 2, Behn-Eschenburg's method consequently gives an open-circuit e.m.f. E_o'=4340 V and a regulation of 31.5 per cent., whilst Rothert's method gives E_o''=3,515 V and r=6.5 per cent. The correct values in this case are E_o=3,875 volts and r=17.5 per cent.

Third Method

Finally, fig. 3 illustrates the conditions obtaining with a power factor of cosϕ=0.8 lagging. With k=IZ_s/V=0.315 and θ=cos^{-1}(R/Z_s)=87°.3, Behn-Eschenburg's method gives E_o'=V×1.225=4,050 V and r=23 per cent. Rothert's method, with F_r'=70 A, F_a'=22 A and ϕ=cos^{-1}0.8=36.°9, gives E_o''=3.475 V, and r=5.3 per cent. On the other hand, taking IZ_o=265 V per phase as determined in fig. 2, and ϕ_o=cos^{-1}(R/Z_o)=83.°8, the e.m.f. induced at full load is found to does not always give results coincident with those obtained by Potier's more detailed construction, it is far more accurate in its approximation to the true value of the inherent regulation than either the Behn-Eschenburg or Rothert methods.

* *Elektrotechnische Zeitschrift*, 1901, Vol. 22, p. 1061.

* The construction of this composite vector diagram from design or test data is due to Potier. See *Elektrotechnische Zeitschrift*, 1901, Vol. 22, p. 1061.

Aluminium Tubes

A BOOKLET recently issued by the British Aluminium Co., Ltd., (391T) contains a good deal of useful matter relating to aluminium tubes and pipes. Some notes on the working of aluminium tubes embody hints on swaging, bending, welding and jointing, while there are a number of tables giving tube and pipe sizes and weights, and safe internal pressures for tubes of various diameters and thicknesses.

Teaching Cable-jointing.

By W. Maskery

Need for a recognised course of training

IN spite of the progress made in transmission and distribution of electricity, little has been done towards training the plumber-jointer. At the present time, knowledge, intelligence and practical skill in cable-jointing are more necessary than ever, due not only to the advanced technique of cable-jointing, but also to the necessity of having a reserve of skilled men in case of national emergency who can repair demaged underground mains in the quickest possible time.

It is regrettable that there is as yet no generally recognised course by which an apprentice must enter the trade. Bad plumbing and sanitation were once a national menace. Education and health authorities, therefore, in conjunction with the Worshipful Company of Plumbers, brought into being a properly organised system of apprenticeship, coupled with the compulsory attendance at day or evening classes at a trade school or technical college. A system of apprenticeship for jointers would have similar results in reducing the amount of shoddy work.

Lack of efficiently trained cable-jointers cannot be regarded as the fault of the authorities, but of the methods of entry of youths into the trade. I believe that practically all those who enter as labourers, becoming jointer's mates and subsequently jointers, would benefit by the facilities offered by technical colleges instead of merely gleaning bits of information as best they can (often from an unreliable source) and obtaining a little haphazard practice here and there. Technical training should terminate in a practical examination, and this should be encouraged by the Institution of Electrical Engineers and particularly by the unions concerned, since a well-trained man would be worth good pay.

Under existing conditions the learning of the art of cable-jointing is usually a haphazard business. A generally recognised course of training for apprentices is overdue and in this article the author suggests a suitable curriculum and also indicates the equipment required in the jointing school

At a technical college the young aspirant secures the advantage of having his own efforts encouraged and thus gaining greater self-confidence when working on "live" conductors. Moreover, he is encouraged to ask questions and to probe into things without feeling that he is expressing his ignorance. He is taught to be able to give a reason, and a sound reason, for every operation he does, and not to follow practice based on caprice. Furthermore, he has an opportunity of becoming conversant with many more features of jointing and types of joints than is possible when he is learning haphazardly by being employed as a mate by a supply authority who would, in the main, rely on one particular type of joint and jointing.

The Necessary Equipment

Equipment needed in a jointing school is large and varied. The first requirement is a well-lit, ventilated, high-roofed shop, with opening skylights to prevent the accumulation of fumes, preferably a brick building with a concrete floor to minimise risk of fire. An oblong shape, in the ratio of 3:1, enables the utmost use to be made of floor space for benches. A courtyard adjacent for coke braziers, or alternatively, an ample supply of paraffin braziers, for the purpose of heating metal and compounds, is also required. At a height of 2 ft. 6 in. from the floor and for two-thirds of the distance round the shop continuously should be a solid work bench projecting 2 ft. from the wall. This is useful for the making-off of indoor tri-boxes. On each end, bolted to the edge of the bench, a 6-in. jaw vice should be provided.

Attached to the front of the bench, at intervals of 2 ft., should be iron or wood collapsible vices, standing 1 ft. higher than bench level, for small joints and single-conductor work, such as telescopic joints, braid and braid expansion joints. These are made collapsible to allow easy removal when full bench level is required. At a height of 3 ft., and a depth of 15 in., the full length of the remaining wall sides should be rigidly boarded with ¾-in. timber for assembling cut-outs. Short pieces of cable can thus be used for the purpose, the bare wall space under the boarding being left for fixing the cable to, and allowing the use of, the "Rawlplug" tool and plugging practice. At each end of the shop should be erected a stout pole of such a height as to permit the erection of an overhead line, extending the full length of the shop and at a height that makes it clear of ground workers, to afford practice in overhead construction and the making off of pole-boxes and low-voltage services.

Across one narrow end and underneath this line should be erected a small steel girder, let into the wall both ends, for the erection of feeder units and distribution panels. Fixed on the wall at a convenient height and under the instructor's control should be provided an insulated bus-bar studded so that a lead can be taken from it to make any particular job alive. Each stud would be controlled by a separate switch so that any one job could be made dead or alive as required without interfering with any others controlled from the same bus-bar, with a fuse between the bus-bar and the supply point for each outgoing lead. Insulating boards also are needed for the students to stand on.

Simulating Working Conditions

An efficient earth should be provided by the water supply which is required, along with a supply of sand, for fire protection. The floor benches should be so designed as to give a position as close to actual working conditions as possible (*i.e.*, the cable should be approximately 15 in. from the floor) and made of 9 by 3 in. planks, dovetailed together with an overall length of 14 ft. by 1 ft., with a clear space of 5 ft. in the centre to accommodate the joint, while the two ends of the cable are held down in a groove in the top portion by means of iron plates and bolts. This prevents any movement of the cable, particularly during test work, when students are tempted to turn the cable round. For extra large work, one of the above type of benches cut and made to slide in a guide box, through which bolts pass to give rigidity on the same principle as an adjustable kerb will be found to suit admirably. An extra room is necessary for storage.

Tools must be the very best procurable. That multi-purpose tool, the hammer-cum-screwdriver-cum-chisel, is the plaything of the boy, not the tool of the skilled man. For every two students there should be one 8-in. metal pot with two 3-in. ladles, an 8-in. enamel saucepan fitted with a griller, and a petrol blow-lamp.

A plentiful supply of the following is also needed: 1¼-lb. straight pine hammers, hacking knives, trimming knives, flat-nosed pliers, hack-saw frames, 10-in. flat files, rasps, shave-hooks, two-hole gas pliers, 10-in. shears, end cutters, side cutters, belling tools (of right design), rat-tail files, round files, 2-ft. rules (wooden), 6-in. scissors, 8-in. screwdrivers, lead dressers, turn-pins, movable spanners, copper-bits, and thermometers reading to 600 deg. F. A spirit level and a lead mallet must also be provided. In addition wooden wedges (made by the students themselves), wooden spreaders (students being taught how to make these for any size cable), should also be available, together with jointing accessories, such as Vernier braid, copper ferrules, lugs of all descriptions, large and small "flat-bottom" compound buckets, and all kinds of insulating materials. Above all, there ought to be a plentiful supply of all types of cable and compound.

The curriculum should be of an interesting as well as constructive nature, covering first the elementary principles of electricity and of distribution, and the construction of all types of electric cables in detail, the instruction being reinforced by a tour of the shops of a cable factory. Each component should be dealt with—lead, copper, rubber, jute, hemp, hessian, steel tape, and wire, together with a demonstration of the many types of paper used for insulating. Rules and formulæ for conductors and cables; mineral and vegetable oils; the set point, viscosity and pouring temperatures of insulating compounds, must also be dealt with.

Importance of Plumbing

Plumbing is a very important part of the jointer's curriculum. It entails a knowledge of the composition of solders, solder making, the alloys and fatigue limits of lead and other metals, the porosity of wiped joints, testing for porous wiped joints, electrical properties of lead, fluxes, the making of fluxes, filling holes in lead sleeves, welded sleeves. Transmission and distribution systems should be fully explained, including mining work and mining jointing.

All conductor joints must be learnt from calculations of conductor sizes and current-carrying capacity. Current capacity of all conductors, electrostatics, voltage and energy, the electric production of heat must all be mastered, and heating, chemical and fatigue effects of current must be clearly understood. Knowledge of simple mains testing is also necessary, as is the treatment of electric shock.

At Brighton Technical College the normal course covers two years. In both years instruction is given in two evening classes lasting 2¼ hr. each, one theoretical and one practical. In the second year the work is mainly concerned with high-voltage cables up to and including 66 kV. After that the work becomes of a specialised character, and is open only to men passing second-year's work with a 95 per cent. result.

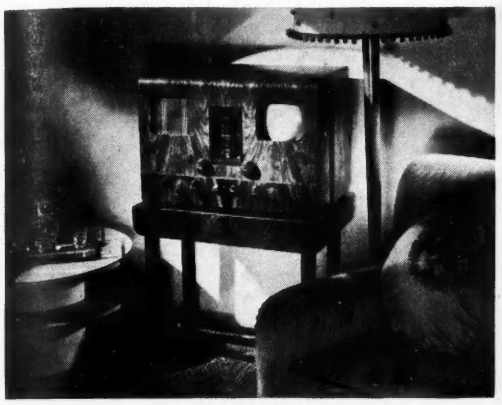
The Radio Exhibition—1

By W. E. Miller, B.A. (Cantab.), M.I.W.T.

Television sets with picture sizes ranging from about 4¾in. by 4in. to 24in. by 20in. will be on view at the annual Radio Exhibition which begins next Wednesday at Olympia. Chief interest in ordinary sound receivers centres around automatic tuning, of which there will be some ingenious examples.

ON Wednesday, August 24th, the thirteenth National Radio Exhibition will open at Olympia, continuing until Saturday, September 3rd. The organisers, the Radio Manufacturers' Association, have this year decided to stress the dual entertainment value of radio by sound and vision, and the exhibition poster calls attention to this by carrying a representation of an ear and an eye.

It must be pointed out, however, that at present only London and the surrounding area has a television service, so that the appeal of television is, as yet, far from being nation-wide. Although claims for the reception of television programmes at a distance of 150 miles or more have been made during the past year, these are for the most part in the nature of "freak" results, and the British Broadcasting Corporation does not claim that the service area extends farther than about 30 miles from Alexandra Palace.



The Marconiphone Model 707 table television and radio receiver shown above gives a picture 4¾ in. by 4 in. on a small cathode-ray tube, and is priced at 29 guineas

Despite this, there are signs that the latter figure is conservative, and that under favourable conditions consistent reception up to distances of 50 miles may be experienced. Much depends on the situation of the receiver and the degree of local interference which is present.

In view of the not inconsiderable proportion of the population at present situated in the television service area, and of the possibility of the opening of further stations at Birmingham and Manchester in the not too distant future, the R.M.A. has felt justified in stressing television at this year's exhibition.

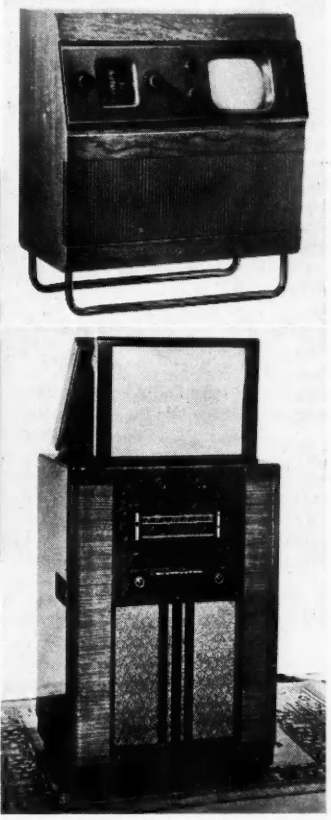
With the co-operation of the British Broadcasting Corporation the Association has arranged for a full-sized television studio at Olympia, from which programmes will be sent out during the run of the show. These programmes will be radiated from Alexandra Palace, and will be picked up, and amplified, and distributed to the stands of most of the television receiver manufacturers, who will have their sets in operation, so that the public will be able to get a good idea of the capabilities of various receivers by visiting the stands in question. In addition, it will be possible to go into the studio, see the origin of the picture, and gain some idea of the studio technique involved.

The television studio this year takes the place of the Radiolympia theatre, which for some years has been an attraction of the show, but which, it was felt by many, detracted from the true function of a radio exhibition.

The dropping of the theatre has made more space available for exhibition stands, and the layout is such that the whole of the stands will be situated on the ground floor, in the Grand and National halls. In the Annexe there will be a section devoted to pianos and music, while part of the Grand Hall gallery has been set aside for exhibitors' offices.

Apart from television demonstrations on the actual stands, it has been found possible this year to arrange for more adequate demonstrations of sound receivers than has been the case previously. Stands will be supplied with two radio (not audio) frequency inputs, consisting of the same programme in two forms, one simulating a local station and the other a distant one.

Although still a long way from the ideal, these r.f. inputs will at least permit a rather better demonstration to be given than in the past, when only the loud-speakers of the receivers were working, from a common audio input.

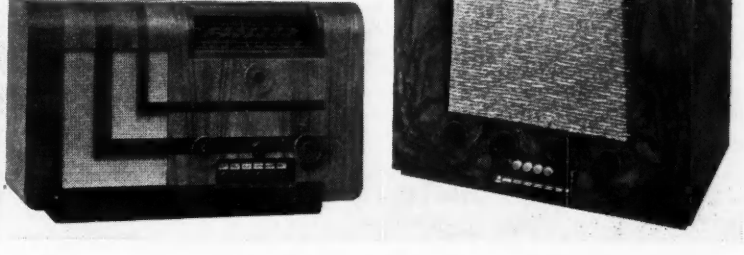


Top: The new Murphy "A58V" television and radio receiver, giving a picture 7½ in. by 6 in., and priced at £45. Bottom: A large-screen television and radio receiver. This Philips model gives an 18 in. by 14¼ in. picture, projected from a high-voltage cathode-ray tube, and also incorporates press-button radio tuning.

Television Exhibits

Many of the well-known receiver manufacturers will naturally be exhibiting television receivers too, and this year the picture size will range from about 4¾ in. by 4 in. (H.M.V. and Marconi) to 24 in. by 20 in. (Scophony). The former employ, like most of the receivers shown, a directly viewed cathode-ray tube, and are priced at 29 guineas, which includes an all-wave sound receiver. The large-screen model employs the Scophony mechanical-projection system, and is the first home receiver to be exhibited by the Scophony Co. Its price is not available at the time of writing. Philips will be showing their improved large-screen model, giving a picture about 18 in. by 14¼ in., and this employs a projection cathode-ray tube.

Between these extremes there will be a host of cathode-ray tube receivers, giving pictures ranging in size from about 7 in. by 6 in. to 12 in. by 10 in. Some of these will have provision for the reception of ordinary radio programmes, while others will receive the vision and its



The Ferranti "515 PB" automatic tuning receiver, with provision for six pre-tuned stations. The right-hand picture illustrates one of the G.E.C. table automatic tuning receivers. Five pre-set stations are available, the sixth button switching the set for manual tuning

accompanying sound only. At the moment it appears that the ruling price is about £30 for a 7½-in. by 6-in. television receiver only, and about £45 for the corresponding model with an all-wave sound chassis in addition. The new Murphy receivers form an example of this, and employ 9-in. diameter tubes. Incidentally, the Murphy concern is exhibiting for the first time in many years.

The tendency this year seems to be towards the use of a tube with magnetic scanning and focusing, and the "Ediswan" 9-in. tube of this type is only 14 in. long, so that receivers using it need not have a very great depth from front to back. Nevertheless, some manufacturers are employing the electrostatic type of tube.

Most of the lower-priced television receivers have what may be said to be a "minimum specification," that is, they have been simplified to the point where any further reduction in the number of valves and components will tend to spoil the received picture or affect the reliability. It is not to be expected, therefore, that any appreciable reduction in price can take place for some time without performance being impaired.

Automatic Tuning

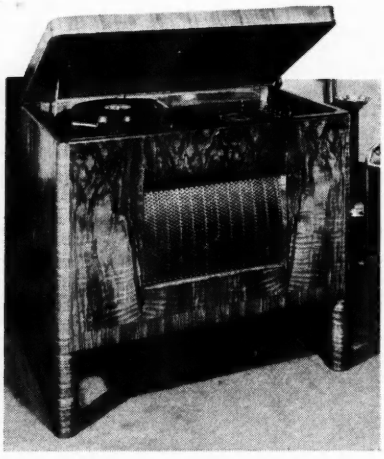
From the foregoing it might be thought that television will be the main feature of this year's Radiolympia, but such is not the case, for the ordinary sound receivers have undergone a partial transformation since last year's show.

This year practically every receiver manufacturer will be exhibiting models with provision for automatic tuning, mostly of the press-button type, although some have simple dial systems. In view of the fact that most of these models outwardly appear to be very similar, it may be as well to point out that many different internal arrangements are being used.

The systems can be divided broadly into three classes. The first, which can be called mechanical, incorporates some arrangement whereby the pressing of a button or lever, or the rotation of a dial, turns the gang tuning condenser to preselected positions for receiving the stations required. The rotating dial system (as used, for instance, by Cossor) enables this to be done very simply.

In cases where push-buttons are used a straight line movement of the button has to be converted into a rotary movement of the conventional gang condenser, and many and ingenious are the ways in which this is accomplished. Levers, cams, and rack and pinion arrangements are among them. Philips and Mullard, however, solve the problem very effectively by designing an unusual form of gang condenser, in which the capacity change is brought about by a linear, rather than a rotary, movement. Simple adjustable push-rods then permit the required displacement of the condenser to be made for different stations.

The second class of automatic receivers is that incorporating pre-set tuning by means of semi-variable condensers, or inductances which can be varied by the movement of their iron cores. The push-buttons operate switches which connect different condensers across the normal tuning coils for each preselected station, or which place different inductances in circuit in the case of the permeability-tuned types. There is usually (though not always) provision in these sets for normal manual tuning in addition to the automatic tuning of some five to ten preselected stations. Many manufacturers, such as G.E.C. and Ferranti, use the pre-set system.



An automatic permeability-tuned radiogram, with automatic record changing, just introduced by H.M.V. and priced at 34 guineas

The third and most advanced class of automatic receivers is the motor-driven type, in which a small electric motor is used, in conjunction with push-button switches and some form of selector system, to rotate the gang condenser of the receiver to the pre-determined positions for the reception of various stations.

In addition to simple motor-driven systems, certain companies, such as "Ekco" and R.G.D., will be showing models in which not only the station selection, but also waveband switching, is performed automatically by the motor drive. The R.G.D. Co. also provides for remote control in some of its receivers.

Apart from the fitting of automatic tuning, startling innovations in receiver design will not be noticeable. There has been a steady improvement in details during the past year, and on the whole the quality of reproduction will show an improvement. The Mullard Co. has brought out an interesting r.f. amplifying valve, which gives a reduction in valve noise, and a noticeable improvement in short-wave reception, and this is being used in many Mullard and Philips receivers.

The B.T.H. Co. has introduced a range of "Mazda" valves with British octal bases, differing somewhat from the international octal types and resulting not only in good performance, but in an appreciable reduction in size. The Mullard Co. has a range of valves in which the side-contact type of base is used, and in which size is also reduced.

Batteries, charging plant, public address equipment, loudspeakers and components have not undergone any startling changes, but in many cases detail improvements will be noted.

A detailed review of Radiolympia will be published later.

The British Association

THIS year's presidential address to the British Association for the Advancement of Science was delivered by Lord Rayleigh on Wednesday. It comprised two parts. The first dealt with "Vision and its Artificial Aids and Substitutes," the second with "Science and Warfare." In the former it is maintained that the main triumphs of science lie in the tangible facts which it has revealed. These are discovered by methods not essentially different from direct scrutiny.

The human eye responds best to wavelengths most abundant in daylight or moonlight and is dead for Nature's primary purpose of finding subsistence under primitive conditions and of defence against enemies. By sacrificing some of its qualities (in particular the large scale of view), others may be enhanced for purposes of research. Natural powers of colour discrimination can be increased by supplementing the lens system of the eye by additional lenses or by prisms, and the useful range of the spectrum can be greatly enlarged by substituting photographic plate for the retina. Another substitute for the retina is the photo-electric cell with an electric wire for the optic nerve and a recording galvanometer for the brain.

While there is no limit in theory to what a telescope can do, there is a definite limit (now practically reached) for the microscope using ordinary light, since points on an object less than half a wavelength apart cannot be distinctly separated. A little may be gained by the use of ultra-violet light with which contrast is obtainable without staining; thus, by the use of the strong ultra-violet line of the mercury-vapour lamp, which has about half the wavelength of green light, a virus contained within a cell shows up as a highly absorptive body.

Although a useful X-ray microscope, analogous to optical or electron microscopes, cannot be constructed (since the course of the rays has to be controlled by tubes or pinholes), X-rays are of fundamental value in dealing with crystals which have a regular spacing comparable in size with the length of the waves.

The development of the "photographic retina" has been brought about by extending the sensitivity of silver salts, which are at a maximum at the violet end of the spectrum, through the yellow-green (where the eye is most sensitive) to the infra-red. This has been done by appropriate dyes. An equivalent of the complex mammalian eye has been built up on separated photo-electric elements in the development of television.

Among the papers of electrical interest presented yesterday was one by Dr. J. D. Cockroft (Section A—Mathematical and Physical Sciences), describing the recent equipment of the Cavendish Laboratory for nuclear research. This includes a 1,200-kV and a 2,000-kV d.c. generator (the latter in course of installation) for speeding up streams of charged particles in transmutation experiments, and a cyclotron. The cyclotron accelerates particles by giving them a succession of impulses as they move in the field of an electromagnet with pole pieces 90 cm. in diameter and should make possible the production of deuterons of energy up to 10,000 kV. Its most important application will probably be in providing sources of new radio-active substances; it also makes possible a much wider range of transmutations than can be produced by ions of 2,000-kV energy, but the d.c. generator furnishes more homeogenous beams of particles and is more suitable for precision work in nuclear processes.

Retirements.

By G. V. Harrap, A.M.I.E.E.

How to obtain an accurate forecast of the probable life of apparatus

WHEN property is retired from service its actual life is known, but up to that time its probable life must be a prediction. If such a prediction, however, is based upon experience with similar property in similar service, the error of prediction need only be small. Ordinarily, the probable life of apparatus and property is required in determining depreciation expense, and for this reason must be ascertained in advance of actual retirement.

In my previous article, "Computing Depreciation" (ELEC. REV., p. 735), I mentioned the necessity for keeping accurate records of the lives of equipment for computing depreciation. Such records are necessary in all types of concerns—supply, manufacturing, retail, wholesale, &c.—and as a guidance as to their use the accompanying series of curves has been developed which can be easily constructed for any property, provided the data is to hand.

For the economic operation of all classes of business an accurate forecast of the probable life of apparatus and property is required in determining depreciation expense. This article shows the best way of obtaining this, having regard to particular circumstances

The essential features required for depreciation calculations are (i) probable life, (ii) number surviving at any time during the maximum life, and (iii) frequency of retirement of units of property or apparatus under consideration. Mention of "surviving members" gives a clue to the type of curve desired. The mortality curves for humans, for example, if plotted with an ordinate of "percentage dying during age-intervals of one year" gives the frequency of retirement from, or relinquishment of, life. The fact that a management order can cause the retirement of large numbers of units regardless of their physical condition (such as d.c. watt-hour meters in a d.c./a.c. change-over) and that economic pressure causes units to be continued in service after they are physically unfit, results in many irregularities in life tables of industrial property that do not exist in life tables dealing with humans. By careful analysis of retirement and life records for property, and skilful smoothing of the resultant curves, reasonable results can be obtained.

To ascertain the number of survivors at any given moment, five methods may be used, *i.e.* (i) individual-unit, (ii) original-group, (iii) composite original-group, (iv) multiple original-group, and (v) annual-rate method. Of these the first and last are the most useful for our purpose. By plotting the percentage surviving against varying years of life a curve such as that in fig. 1 is obtained. From this the frequency of retirement can be plotted, and its peak will be the mode of the former curve (mathematical theory will explain why the mode does not necessarily coincide with average life). From these two curves, that of probable life can be deduced, as has been done in the graph.

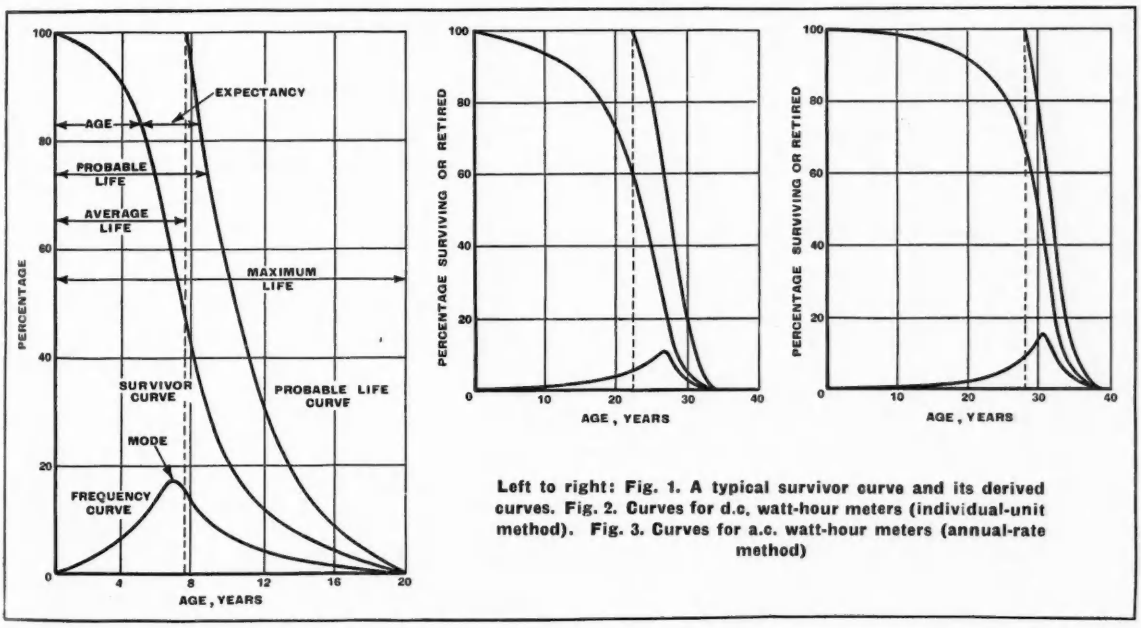
Frequently, available data show only the number of units retired during a given year or series of years, together with the age of each unit at its retirement. If these retirements are arranged in order of their ages and then summed from the oldest to the youngest, a survivor curve can be plotted from the successive sums. This is what is known as the "individual-unit" method, and the resulting curve shows the units remaining in service at any given age. Neither the method nor the original data take into account other units remaining in service during or at the end of the observation period, so that the average life indicated by an individual-unit survivor curve is exactly the average at retirement of the units given consideration. Since all units are retired from service, an individual-unit survivor curve will always range from 100 per cent. surviving at zero age to zero per cent. surviving at maximum life. The method is therefore of most use in determining the probable life, &c., of a batch of units which are comparable with some similar batch which have already been retired, or are being retired by the new batch.

The application of this method to d.c. watt-hour meters is shown in fig. 2. The results are obtained from records of 2,125 instruments retired between 1925 and 1932. The maximum life was 33.5, but the average was only 22.4, while the modal life was 26.5.

The annual-rate method takes its name from the fact that the rate of retirement is calculated for each like-age group of units in service during the observation period which includes one or more years. Calculations of values for a survivor curve by this method requires two sets of data: First, the number of units retired during the period of observation and their ages at retirement; and secondly, the number of units in service at the beginning of the observation period and their ages. The first data is the same as that required for the individual-rate method.

From these two tabulations the rate of retirement is calculated for each age corresponding to the ages of the units in service. Since the rate is usually calculated for a year's retirement it is generally the annual rate, or, in other words, the percentage of the units of a given age in service at the beginning of a certain year which were retired during the following year. If at the beginning of the observation period the data include the units installed in the prior year and each successive year, the annual rates for each age interval from 0-1 to the age of the oldest unit in service will result. If these annual rates are then applied successively to the percentage surviving at the beginning of each age-interval, starting with 100 per cent. at zero age an annual-rate survivor curve will be the result.

These annual rates normally increase as the age increases, and if all of the oldest units are removed, the last annual rate will be 100 per cent. The survivor curve in this case will range from 100 per cent. surviving at zero age to zero per cent. surviving at maximum age. However, since in most cases the data are irregular, the annual rates will show only a



Left to right: Fig. 1. A typical survivor curve and its derived curves. Fig. 2. Curves for d.c. watt-hour meters (individual-unit method). Fig. 3. Curves for a.c. watt-hour meters (annual-rate method)

tendency to increase, and will fluctuate up and down. Frequently the survivor curve will be a "stub curve," which will not reach zero because not all of the oldest units observed were removed during the observation period.

The probable average life (obtained by the usual method of determining the area under the completed survivor curve) for survivor curves constructed by the annual-rate method is a reflection of the average rate of retirement for the observation period chosen. It takes into consideration not only the current retirements, *i.e.*, the deaths, but also the units remaining in service, *i.e.*, the living, and utilises them in accordance with both their number and age. Such a calculation results in a true picture of rate of retirement since it includes all units involved and their ages. In effect, it takes into consideration the prior retirements because the annual-rate is dependent upon both the age and the number of units that are still in service.

This annual-rate method is not applicable to property groups for which replacements were not made for continuous years beginning with zero age. The first annual rate must be applied to 100 per cent., and if this rate is for an age interval greater than 0-1 there is no way, other than by assumption, of determining the starting point of the curve. This objection is not a serious one, however, for a case of this kind would exist only when the type of unit had been discontinued some years previous to the observation period.

In many applications of the annual-rate method the retirements for any single year may not reflect normal conditions of the property, but a series or band of years may be chosen in order to get average conditions. The units retired for each respective age and the units exposed to retirement for each age over the band of years are totalled before the annual rate is calculated. For small property groups and for years of uneven retirements and replacements a band of years is preferable.

Curves for 5, 10, 15, 25, and 50-A a.c. watt-hour meters are given in fig. 3. The number of units studied was 43,214 and the number retired was 1,043. The maximum life was 38.0, while the average was 28.2 and the modal peak occurred at 30.5 years.

Correspondence

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Electrical Interference

IN dealing with the general problem of electrical interference in your issue of July 1st, Mr. G. W. Ingram fails to make adequate distinction between radio and telephone interference, both as regards the cause of the disturbances and their eventual suppression. It should be made clear that the spectrum of the radio-frequency disturbance has an entirely different cause from that responsible for the audio-frequency spectrum, except in special cases such as mercury-arc rectifiers, for example. Accordingly the application of the term "harmonic" to the description of both telephone and radio interference is liable to be misleading in the instances given where the causes of the two kinds of interference are entirely different.

The author refers to the work of several bodies in the field of telephone interference but omits to mention one of the most important contributions, namely, that of the C.C.I. The latter body has issued recommendations relating to telephone interference which are accepted by the majority of organisations concerned with this problem. The translated title of the C.C.I. publication is "Guiding Principles Concerning Measures to be Taken in Order to Protect Telephone Lines Against the Disturbing Influences of Heavy-Current or High-Tension Power Lines."

Turning to other details in the article, I would mention the following:—

(a) Methods of Propagation: Conducted Interference: The difference between the effects of the high and low frequency disturbances of the sources mentioned is not made clear. For example, conducted interference may be due to the passage of radio-frequency noise and/or broadcast signal from the mains to the high-frequency portion of the receiver. It may also arise from the low-frequency ripple in the h.t. supply due to insufficient smoothing; the latter form of disturbance is quite distinct from the former in that it is not of a high-frequency nature.

(b) Suppression Apparatus: The capacities and inductances of the radio-frequency filter suppressors of the type described in B.S.S. 613 are not in general arranged to resonate as the author suggests. In particular, fig. 2 does not represent the normal radio-frequency suppressor in which chokes are employed.

(c) Notes on Design: The author expresses the opinion that iron cored chokes are unsuitable for use as high-frequency suppressors. This view is not sustained by recent work, which has shown quite conclusively that chokes with laminated-steel cores render possible the construction of suppressors which would be impracticable as regard weight and size if this feature were not employed.

In passing, I would mention that the most important limitation attaching to the size of the asymmetric capacitance in a radio-frequency suppressor, *viz.*, the liability to shock, is not mentioned. Certain errors are apparent in the calculation of the reactances of the filter elements in fig. 2.

The author remarks on the low standard of both installation and maintenance of electrical apparatus installed in factories It should be mentioned that interference from this source is not quite as serious as might be anticipated. Factories come under the jurisdiction of the Home Office, who are in a position to enforce a code of rules which in point of fact requires a high standard of installation and maintenance. Compared with this, the power over domestic installations possessed by the Electricity Commissioners and power supply authorities is limited and indirect; the approved code, namely, the I.E.E. Wiring Regulations, is completely applied in only a minority of cases.

L. H. DANIEL.

E.R.A. Research Laboratory, Greenford, Mdx., *Aug.* 15*th*.

Plugs and Sockets

I was very interested in the letter written by "Ignoramus" in the issue of August 12th.

Like many others, he thinks the local electrical man is waiting to be "taken off the hook" for his use. If he gets any trouble it is usually a 'phone call "Please send a man at once."

If he would call at his local E.C.A. man's showroom he would find just as good bargains as in the stores; also there is personal attention and advice to be given. The local man is usually a heavy ratepayer and depends on local customers for the majority of his sales. He would also know the size of plug to fit, or he would make it his business to find out for his customer.

It is these small services which, I think, help to encourage the sale of electrical appliances and so turn such as "Ignoramus" into enthusiastic and satisfied users.

North Finchley, *August* 13*th*. SADD & HALSEY.
M. HALSEY.

The letter from "Ignoramus" is only another proof that for electrical apparatus the public should deal with electrical contractors—either registered or E.C.A. members. We think we can safely say that any of these would willingly have fitted the correct plug when supplying the fire.

The electrical contractor specialises in electrical apparatus, so why go to stores that cannot specialise?

Birmingham, *August* 13*th*. BILL SWITCHGEAR, LTD.,
R. A. BILL.

"Supply Engineer" writes expressing similar views and asking whether something cannot be done to stop this general dealing in electrical goods by people who possibly do not even know the rudimentary principles of electricity. He considers it small wonder that accidents happen, and also mentions the unnecessary costs to the supply authority.

"Radiosondage"

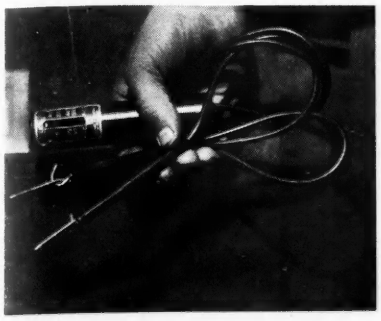
IN a résumé of the decisions made at the International Telecommunication Conferences at Cairo, the July issue of *Electrical Communication* refers to "radiosondage," the name given by meteorological departments to the investigation of air currents in the upper atmosphere with the aid of small free balloons provided with a simple radio telegraph transmitter, the automatic operation of which is controlled by measuring instruments (barometer, thermometer and hygrometer). As the course of the balloon can be followed by means of a radio direction finder, the force and direction of the winds in the upper atmosphere can be determined when the sky is overcast and visual observations are impossible. The power of the balloon transmitter is only about 1 W and so interference caused by other radio services is serious. The Conference accordingly allocated to "radiosondage" two exclusive wavebands in Europe (2,050-2,070 kc. and 94.5-95.5 Mc.). A further allocation of 27.5-28 Mc. is exclusive everywhere except in the American continent, where it is shared with fixed and mobile services. It is planned to have sixty meteorological stations in Europe equipped for "radiosondage" investigations. In addition to services developed in France and America, measurements have been made in Greenland, the Sahara Desert, and also from a ship in the North Atlantic.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Lampless Voltage Tester

Designed for use on circuits up to 600 V, what is claimed to be an entirely safe voltage tester, indicating either a.c. or d.c. voltage on a plainly marked scale, has been placed on the market in the United States. As no lamps are required, the inconvenience of carrying several of these to suit different voltages is obviated. It is said to be practically unbreakable and accurate. One lead wire is placed or hooked into each side of the circuit and the dial shows the voltage and also indicates whether the circuit is a.c. or d.c. The points of the two lead wires may be sharpened so as to pierce insulation. The tester determines 25- or 60-cycle frequency and can be used for locating open circuits, blown fuses, and defective fuses on three-phase motors running single-phase. The equipment is made by the SQUARE D. COMPANY, 6060, Rivard Street, Detroit, U.S.A.

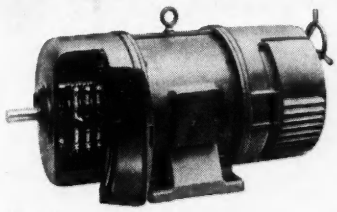


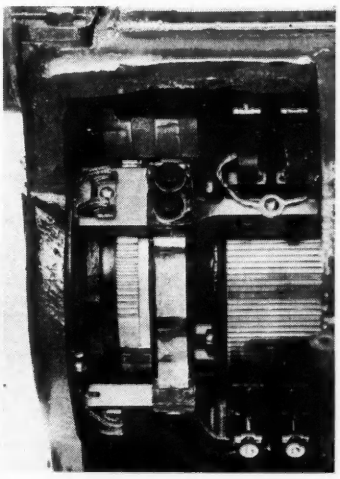
A lampless voltage testing outfit

A.c. Commutator Motor

With particular reference to printing and allied trades, J. H. HOLMES & Co., LTD., Hebburn-on-Tyne, have produced a variable-speed commutator motor (type C.H.) for use on two- or three-phase circuits.

The range of speed is normally three to one, but much wider variations can be met. It is effected by moving two brush rockers in opposite directions by means of a rack and pinion; this alters the amount of rotor speed regulating winding in circuit with the stator winding. The machine is started by returning the brush gear to the starting position (which can be done automatically) and closing the line switch; interlocking contacts in series with the release coil of the line switch prevent the closing of the starting switch before the brush gear is in its correct position.





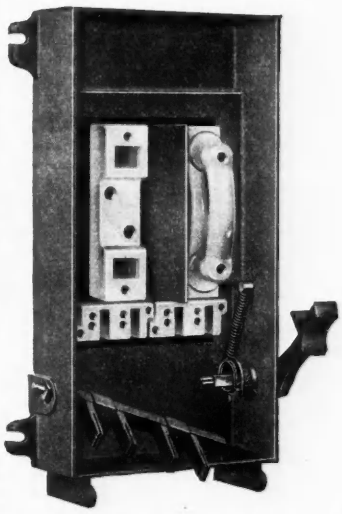
Type "CH" commutator motor with the slip-ring inspection doors open and (right) a close-up view of the commutator and brush gear

An inherent speed regulation with varying load similar to that of a d.c. compound motor with shunt regulation, is claimed with a difference of less than 10 per cent. between no-load and full-load speeds at any brush position. Remote electrical or mechanical control can be provided. A pre-set speed device is also available by which the motor will accelerate to a predetermined speed when the starting button is pressed; thereafter the speed is controlled by the "raise" and "lower" push-buttons. The primary winding is at the bottom of the rotor slots and connected to the mains through slip rings, and above it is a speed-adjusting winding which is connected to the commutator. The secondary winding is in slots in the stator. Power factor approaches unity at maximum speed and is similar to that of an induction motor at synchronous speed. The starting torque is twice full-load torque with a starting current one-and-a-half times full-load maximum-speed current.

New Switchgear

The "Ordsal Lancastrian" switches and switchfuses are recent developments by DORMAN & SMITH, LTD., Ordsal Electrical Works, Salford, 5. The most important feature of this new range is the introduction of a detachable switch arm. By unscrewing a bush this arm can be extracted from the case, leaving the whole of the space free for wiring.

In models of over 15 A the fixed contacts are milled out of the solid, contact pressure being obtained by laminated spring phosphor bronze blades. The q.m. and b. mechanism has been so designed that the main spring, normally undistorted, is in compression only during the operation of the switch, and in the unlikely event of the failure of the main spring a secondary spring provides independent quick-break action. The fuses are of the D. & S. rewirable type fitted with self-aligning spring contacts. Alternatively, high rupturing capacity cartridge fuses tested to 25,000 kVA can be used instead on both alternating and direct current circuits at pressures of up to 650 V.



The "Ordsal Lancastrian" switch-fuse

The switches, which are rated at 500 V, are made in 15-, 30-, 60- and 100-A sizes.

Belling & Lee Accessories

Two recent developments by BELLING & LEE, LTD., Cambridge Arterial Road, Enfield, are of particular interest to manufacturers of television receivers, and to those requiring terminations for coaxial cable.

The first example is a high voltage valve-holder suitable for 12,000 V operation. This has been specially designed to overcome difficulties encountered with corona discharges at the higher voltages. The unit has been very carefully tested.

The other component is a coaxial plug and socket and this is available in two types, with bushes either for solid dielectric or air-spaced coaxial cable. The flex portion is supplied with either a large or small bush in the termination according to the type of cable which will be used.

The employment of a tapered bush for gripping screening is quite a new development and one which should appeal widely to users.

Cooker Improvements

To the benefits of thermostatic control for domestic electric cooking has been added automatic time control, thus allowing the cooking to be done entirely automatically, while the housewife is left free to go out—a development which will help the electrical industry to outpace the efforts of the gas cooker manufacturers.

This development is to be introduced by the HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, London, W.1, which is making a cooker — the standard No. 6052—with thermostatic control, a four-heat "Torribar" boiling plate and a special time clock, the latter being situated in the splash plate at the back of the hob.

The "Hotpoint" No. 6052 cooker fitted with automatic time control

The clock has a self-starting movement and the timer can be switched off

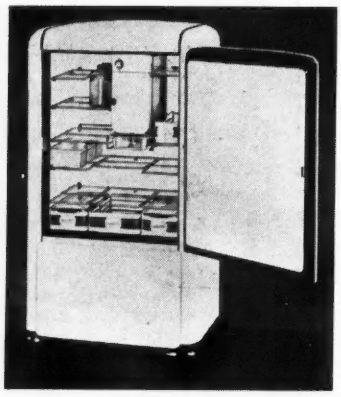
when it is desired to operate the oven in the ordinary way. This development should be of special interest to supply companies who may frequently have to put forward something in direct competition with the thermostatic gas cooker.

Another new cooker is the "Creda Unit" model of the SIMPLEX ELECTRIC CO., LTD., Broadwell Road, Oldbury, Birmingham, which has been specifically designed as a space saver for small households or flats. Technically it is designed similarly to the large "Creda" cookers. It has a 2-kW 12 in. by 9 in. griller.

The oven, which has a loading of 1,500 W, measures 11 in. by 11 in. by 11 in. The cooker is built up of three distinct partsthe grill, the oven and the legs, all of which are obtainable separately.

A 7-cu. ft. Refrigerator

The latest addition to the range of H.M.V. refrigerators of the GRAMOPHONE CO., LTD., 104, New Bond Street, London, W.1, is a 7 cu. ft. model known as the "P.718" to replace the "P.727," a special feature is movable shelves which make the shelf arrangements variable to cope with different



The H.M.V. 7-cu. ft. refrigerator

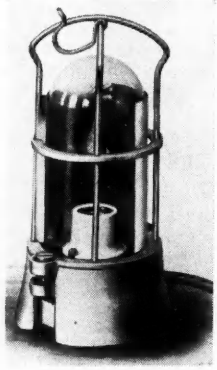
foodstuffs. The glass dish has been increased in depth and fitted with an eight-piece glass dessert set. When this set is removed the dish may be used for storing fish. A utility basket which is provided is suitable for storing fruits and salads.

The general specification of the refrigerator is as follows: 63½ in. high by 33½ in. wide by 22 in. deep, the net storage capacity being 7.1 cu. ft., with a shelf area of 15.4 sq. ft. distributed over six shelves. There is provision for 101 ice cubes, and vitreous enamel finish is employed both internally and externally.

A Stand-Handlamp

A watertight handlamp which can equally well be stood on the floor is being made by the SIMPLEX ELECTRIC CO., LTD., Broadwell Road, Oldbury, Birmingham.

The body is constructed of a light aluminium alloy and forms a self-supporting base with the cable out-



The "Simplex" stand-handlamp

let at the bottom, so that the lamp stands firmly on the floor without danger of rolling away or falling over by the weight of, or a pull on, the trailing cable.

A convenient carrying handle and hook are provided which can be folded out of the way. The lampholder has a special seating to protect the lamp against vibration, and a fully visible but protected earth terminal and gland for t.r.s. cable are fitted as standard.

Tool Grinding

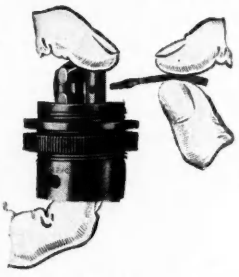
A bench and pedestal electric grinder, type "GB.6," designed to comply with the requirements of the new Factories Act, has been put on the market by S. WOLF & CO., LTD., Hanger Lane, Ealing, W.10. Two

The new "Wolf" grinder

wheels are fitted as standard, one fine and one coarse, each 6 in. by ½ in. Each machine is provided with a built-in water container, starting switch, carrying handle, 3 yd. of c.t.s. cable with earth lead, adjustable tool rests and pressed-steel wheel guards. The ¼-h.p. (220-250 V single-phase or 220 and 415 V three-phase) motor has a dynamically balanced rotor and runs at 2,800 r.p.m. in ball bearings, fitted in housings holding lubricant for two years and with dust-resisting felt glands. A ½-in. chromium-nickel grinding spindle is provided. With a.c. models a slow-break switch is supplied.

An Unusual Lampholder

W. & E. KUPFER, 2-4, Finsbury Street, London, E.C.2, have introduced a cord-grip shade-carrier bakelite holder, the special feature of which is in the plungers, there being no screws at all. The connection is made by depressing the plungers with finger and thumb (as in the illus-



The "Kupfer" bakelite holder

tration) and inserting the flex. This makes positive contact which, when the holder is fitted, it is claimed to be impossible to pull adrift and also makes the holder of the really easy wiring type. The cord grip will take a direct pull without any electrical connection of sixty-four pounds.

A Hot-water Circulator

The "Bolton" external hot-water circulator, a new product manufactured by G. RAE-ARNOT CO., Cupar, Scotland, has been designed for fitting to existing boilers. Broadly, the principle of operation is the provision of an element of a compact type so situated in a small chamber as to impart its heat rapidly to the water, setting up circulation and delivering hot water to the top of the tank.

The construction is tubular and connections are available to suit any form of hot-water tank, it only being necessary to drill two small holes for fixing. Apertures are available for fitting an automatic heat control switch or for cleaning out scale when used in hard water districts. The heat control can be fitted so that it operates either immediately hot water is drawn off or only after the water has been drawn off some appreciable time.

The elements can be withdrawn without removing the circulator from the tank, and the end carrying the connecting terminals is situated adjacent to the cold-water inlet.

An Improved Hand Dryer

An improved model of the company's hand dryer has just been introduced by BYLOCK ELECTRIC, LTD., 109, South Street, Ponders End, Middlesex.

At the top of the casing is a filtering device by means of which air drawn into

The improved "Bylock" hand dryer

the machine is filtered and impregnated with disinfectant. A cowl has also been fitted to the outlet, thus ensuring much quicker drying. A ball joint fitting enables it to be placed at the most convenient angle.

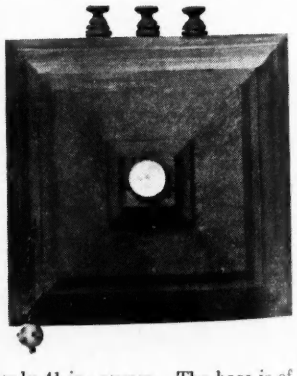
"Snow White" Lights

The eight lively characters of "Snow White and the Seven Dwarfs" have been reproduced in fully coloured action pictures on the special non-inflammable translucent shades of "Mazda Snow White Lights" made by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2.

These new outfits are 12-lamp sets suitable for operation on 200/260 V. They comprise flexible cord, lampholders, special combination plug-adaptor and "Mazda" lamps (including one spare). The ingenious "Berry Bead" device enables each lampholder to be separately and quickly secured to the branches of Christmas trees and other supports.

A Novel Bell Light

The "Bell-lite" has been designed to supersede the ordinary bell alarm which is often inconveniently loud, replacing it by a soft buzzer and a light-signal, so that if the buzzer is not heard the light will be seen. Should the person called be out of the room, the light being on will indicate to him on



The Ashton "Bell-lite"

his return that he has been called.

Either the light or buzzer can be put out of action, so that the device lends itself for use in sick rooms, &c. The size of the "Bell-lite," which is made by H. ASHTON, Bull's Head Passage, Market Place, Manchester, 4, is only 4½ in. square. The base is of wood and the cover is bakelite, a cord being provided for readjusting the light-switch after a call. The buzzer may also be adjusted to be heard through a telephone.

Swedish Electrical Trade

Large exports of power plant

THE following table gives the values of the principal groups of Swedish electrical imports and exports, with the chief countries of origin or destination. The figures are taken from the official foreign trade returns of Sweden. It will be seen that the export trade as a whole was larger than the imports, that in power plant being about ten times as great. An outstanding exception was radio apparatus, the imports of which amounted in value to more than ten times that of exports; minor exceptions were wires and cables, switches and meters. Although imports from the United Kingdom increased during the year they still form but a small proportion of the whole trade. A close examination of the returns shows that Sweden is continuously widening the scope of her export trade. (The exchange value of the krone is approximately 1s.)

	1937 Kr. (000)	Inc. or dec. on 1936 Kr. (000)
IMPORTS.		
Batteries, accumulators and parts—		
Total	2,277	+ 277
From United Kingdom	480	+ 100
,, Germany	770	+ 110
Radio apparatus—		
Total	17,753	+ 3,993
From United Kingdom	2,070	+ 314
,, Germany	3,910	− 410
,, Holland	6,410	+ 2,416
,, United States	3,170	+ 883
Motors, generators, convertors and transformers—		
Total	9,161	+ 1,633
From United Kingdom	566	+ 106
,, Germany	5,550	+ 613
,, United States	1,060	+ 420
Stators, rotors, current collectors, etc.—		
Total	1,015	+ 305
From United Kingdom	82	+ 42
,, Germany	706	+ 216
Metal filament lamps—		
Total	2,210	+ 630
From Germany	1,043	+ 297
,, Holland	534	+ 134
Carbon for electrical purposes—		
Total	3,230	+ 595
From United Kingdom	472	+ 157
,, Germany	1,424	+ 186
Regulating and control apparatus—		
Total	620	+ 120
From United Kingdom	30	+ 7
,, Germany	407	+ 101
Switches, etc.—		
Total	4,870	+ 900
From Germany	4,277	+ 757
,, United Kingdom	49	+ 3
Electricity meters—		
Total	1,444	+ 54
From Germany	1,316	+ 26
Other electrical measuring instruments—		
Total	1,278	+ 325
From United Kingdom	91	+ 11
,, Germany	936	+ 231
Insulated cables and wires—		
Total	7,861	+ 3,231
From Germany	6,335	+ 2,455
,, United Kingdom	96	+ 36
X-ray apparatus—		
Total	548	+ 178
From Germany	489	+ 159
Vacuum cleaners—		
Total	1,158	+ 138
From Germany	992	+ 729
EXPORTS.		
Motors, generators, transformers and converters—		
Total	16,644	+ 3,928
To United Kingdom	703	− 232
,, Germany	345	+ 177
,, China	212	− 68
,, Italy	296	+ 159
,, Irish Free State	490	+ 150
,, Canada	784	− 40
,, Argentina	631	+ 45
,, Brazil	1,137	+ 584
,, Australia	390	+ 100
,, Norway	1,022	+ 198
,, Finland	3,460	+ 1,948
,, Eire	489	+ 152
,, Denmark	518	+ 328
,, New Zealand	244	+ 64
,, India	703	− 10
,, British S. Africa	936	+ 184
Vacuum cleaners—		
Total	9,579	+ 5,221
Accumulators, batteries and parts—		
Total	2,107	+ 697
Stators, rotors, etc.—		
Total	551	− 113
To United Kingdom	157	+ 15
,, France	131	− 42
Switches, etc.—		
Total	1,376	+ 696
To United Kingdom	210	+ 25
,, Finland	304	+ 177
Telegraph and telephone apparatus—		
Total	7,495	+ 935
To Italy	362	+ 355
,, British South Africa	479	+ 53
,, Poland	746	− 789
,, India	51	+ 35
,, China	240	+ 71
,, Finland	977	+ 171
,, Norway	699	+ 436
Insulated wires and cables—		
Total	5,858	+ 3,195
To United Kingdom	187	+ 107
,, Mexico	437	+ 272
,, Poland	111	+ 21
,, Finland	804	+ 368
,, Argentina	898	+ 680
Metal filament lamps—		
Total	1,018	+ 33
To Denmark	93	− 3
,, Norway	68	− 32
,, Finland	49	+ 9
,, Turkey	48	− 69
,, Argentina	263	+ 107
Carbons for electrical purposes—		
Total	603	+ 173
To United Kingdom	13	+ 3
,, Norway	269	+ 104
Radio apparatus—		
Total	1,501	+ 405
To Finland	790	+ 83
,, Brazil	14	+ 3
,, Argentina	4	—
,, India	10	− 90
,, Norway	220	+ 120

New Books

Engineering Electronics. By D. G. FINK. (Pp. 358; figs. 217.) London: McGraw Hill Publishing Co., Ltd. Price 21s.

The author has set himself the difficult task of bridging the gap between the textbook devoted primarily to electron theory and that which describes the use in industry of various standardised electronic devices and circuits. Catering for the engineer wishing to widen his knowledge of electron physics and its applications, Mr. Fink's book will form a useful addition to the libraries of both schools and industrial undertakings. Divided into three related parts, the book makes interesting reading, whether the parts are considered separately or as a whole.

Part I deals with physical electronics, and the method of treatment is suitable for those whose mathematical equipment falls short of the calculus. Its limitation to four chapters has resulted in certain sections being condensed to an undesirable extent, but this is offset in some degree by the bibliographies at the end of some of the chapters. In the section devoted to electron tubes the function of the various electrodes used in the construction of thermionic valves is discussed, and some useful information on tube characteristics is provided. The chapter on gas-filled triodes and tetrodes makes interesting reading, as does that on photo-sensitive cells. Both the electrode tube types and photo-voltaic cells receive some attention. The chapter which deals with electronic sources of light gives the latest American practice in this field, and here again the author has had to condense a large amount of material into a short chapter.

Part III deals with electron tube applications, and the reader is introduced step by step from simple circuit theory to power transformation circuits, and finally industrial control circuits. We can recommend Mr. Fink's book to those wishing to know more about the latest developments in engineering electronics.—J. N. A.

The New Management. By H. T. HILDAGE, T. G. MARPLE and F. L. MEYENBERG. (Pp. 358; figs. 64.) London: Macdonald & Evans. Price 16s.

This new book is really two books in one. About a third of the work is devoted to a general and abstract treatment of the principles of management, and so far as this part is concerned the authors offer nothing new and nothing in advance of the many works that have already appeared along these lines. The remainder of the book, however, deals specifically with time and motion study and associated problems and this section is a real and valuable contribution to the available literature on management.

One of the three collaborators, Mr. F. L. Meyenberg, was formerly manager of the German Institute of Work and Time Studies and chairman of the Institute of Cost Accounting and Financial Control. Mr. Meyenberg has drawn upon the German publications with which he was personally connected to give an excellent description of the aims, objects and methods of time and motion study, or, as he prefers to call it, work and time study. This description is rounded off with detailed examples of the use of such studies in various branches of the German iron and steel, and metal working industries. The whole of the section is copiously illustrated, perhaps the most interesting illustrations being those giving the essence of the German standards for cutting tools, and this section of the book is certainly as authoritative as anything yet written on the subject.

Although the examples given of practical work and time studies do not deal specifically with the electrical industry, they will well repay study not only by firms that are just contemplating work and time studies, but also by those in which work and time studies are already an accepted part of the management technique.—A. W. W.

Incentives and Contentment. By P. HALL and H. W. LOCKE. (Pp. 187.) London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d.

During the past few years enlightened management has come to recognise workers as more than mere cogs in the production machine and to realise that a contented force of workers pays well in increased efficiency and reduced waste. The Rowntree factory has been well to the fore in recognising the significance of the human factor in industry, and this book describes an investigation made over a long period towards developing more fully the sense of co-operation between the company and the rank and file.

Although the book deals specifically with this one case it points to principles that are capable of general application. Lost efficiency in a working force results often from quite small things that affect the worker's satisfaction with his job and that could easily be put right if dealt with properly. The book deals with this problem of satisfaction and discontent in the workroom and chapters are also devoted to motives and incen-

tives to work, leadership in the workroom, and the " difficult " worker. The methods and results of the investigation are dealt with exhaustively, and in a preface to the book Mr. B. Seebohm Rowntree acknowledges the practical value of the investigation.

It is difficult to read the book straight through without running off on a speculative train of thought as the authors bring out points that, although already subconsciously appreciated, have not previously been realised in their true significance. This is perhaps the best recommendation one can give a book of this kind.—A. W. W.

Electron and Nuclear Physics. By J. B. HOAG. (Pp. 502; illus.) London: Chapman & Hall. Price 20s.

This is a book about the electron. It starts with the early measurements of the e/m ratio and describes the later conceptions of the wave length of the electron and Einstein's photoelectric equation. Passing through thermionic emission and X-rays we come to the consideration of the structure of the atom, nuclear physics, transmutation and the apparent properties of cosmic rays.

What makes this book differ from most other books of the same scope is that it is also a practical textbook. Each chapter closes with an experiment and there are four chapters at the end on laboratory techniques.—W. R. C.-A.

Roget's Dictionary of Electrical Terms. By S. R. ROGET. (Pp. 425.) London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d.

This work of reference is one which we personally use quite frequently. It might be more aptly termed a collection of expressions in common use. This third edition has been revised and enlarged, though its bulk has not been materially added to (425 instead of 396 pages). Conciseness is one of its virtues and much space has been saved by the omission of obvious combinations and needless repetition of cognate forms. Trade names are used only when distinction is necessary to avoid misconception. The subject-matter has been kept strictly within the electrical boundary; for example, many terms in railway signalling not inherently electrical have been left out and the purely " traffic " side of telephony and telegraphy is not dealt with. The author's purpose has been to explain (without trespass on the functions of the textbook) rather than define in the I.E.C. and B.S.I. sense.—W. O. F.

Photoelements and their Application. By Dr. Bruno Lange, translated by Ancel St. John. (Pp. 297, figs. 67.) New York: Reinhold Publishing Corporation. Price 27s. 6d.

This is a book devoted almost entirely to photocells of the rectifier or "sperrschicht" type and is a translation of the German written in 1935 (Part I) and 1936 (Part II). The style of the English version is in parts somewhat unexpected, at least to the average English reader. The translator is not entirely responsible, however, as may be seen from the first paragraph of the text. The appearance of an English translation of a book written by so eminent an author, and dealing exclusively with an instrument so lately developed, is an event of some importance. Its publication is all the more welcome in the absence of any other authoritative treatise on the same subject. For these reasons at least the book is to be recommended to both the student and the user of photoelectric cells.

Part I of the book (pp. 13-169) is given to theoretical treatment and the physical properties of the photocells. The theoretical treatment is on somewhat elementary lines and does not take account of modern developments in wave mechanics. What is, perhaps, more surprising is that considerable space is taken up with discussion of the properties of the cuprous oxide cell, which has been largely superseded by the cell of the same type employing selenium as the light sensitive element. Rapid strides have been made in the past two or three years in the commercial development and perfection of the selenium rectifier cell, and a more extensive discussion of its properties and failings as a measuring instrument would have served a useful purpose.

However, one cannot read carefully through the section on physical properties without becoming aware of the fact that the use of these cells to obtain accurate results is by no means a simple matter. That the particular errors involved may vary considerably from cell to cell is, perhaps, not so clearly stated. For instance, one might gather from the diagram on page 104 that the temperature coefficient of the photocurrent in a selenium rectifier cell is negligible at ordinary room temperatures, whereas in practice this is by no means always the case.

Part II (pp. 173-288) deals with practical applications of the rectifier cell and is a good, if somewhat optimistic, summary. Both parts conclude with lengthy bibliographies, but these are not fully representative of work done outside the author's own country. Finally, it may be mentioned that details of manufacture of rectifier photocells are not touched upon.

This is an interesting and informative, though not entirely up-to-date, treatise on one of the simplest and at the same time, perhaps, the most deceptive measuring instruments developed in recent years. J. S. P.

Der Schutzbereich von Blitzableitem. By DR. ING. ANTON SCHWAIGER. (Pp. 115; figs. 27.) Munich: Verlag Oldenburg. Price Rm.5.

According to Dr. Schwaiger, Germany suffers losses from lightning amounting to 15 million marks per annum. It has therefore been decided to include the question of lightning protection in the four-year plan of the Reich.

The book under review has as sub-title " New Rules for Constructing Lightning Protection Arrangements," and is divided into six sections: the development of lightning protection, the protective space, deduction of rules for constructing lightning protectors, observations, scientific base, and researches. The first section gives an admirable and entirely unbiased account of the work of pioneers in lightning protection from that of Franklin in 1755 to Anderson in 1885. Special reference is made to the investigations of L. H. Melsens, Professor of Physics and Chemistry, as a result of the tower of the town hall of Brussels having been seriously damaged by lightning in 1863.

The printing and production are good, and the book is recommended to all who are interested in lightning protection of buildings.—C. W. M.

Shorter Notice

"Tables of Functions and Formulæ and Curves," by Dr. Eugene Jahnke and F. Emde. In German and English. (Pp. 303; figs. 181.) Price Rm. 11.25. "Grimsehls Lehrbuch der Physik," by Dr. R. Tomaschek. (Pp. 866; figs. 1,209.) Leipzig: Verlag B.G. Teubner. Price Rm. 19.50.

Favourable Year in Ontario

OPERATING conditions throughout the year ended October 31st last were unusually favourable, states the thirtieth annual report of the Hydro-Electric Power Commission of Ontario, of which Mr. T. H. Hogg, B.A.Sc., C.E., D.Eng., is chairman and chief engineer. Relatively little damage to lines and equipment was caused by lightning, sleet or gales, and interruptions of service were small both in duration and areas affected. Much of this freedom from trouble was due to the policy of systematic testing and replacement of defective insulators and apparatus and to the employment of relays and automatic switches of modern design. Continuity of operation, it is stated, is increasingly demanded in rural as well as urban communities.

During the year under review there took place the greatest expansion in rural supplies on record. The number of rural consumers added was 12,580 (making the total 86,194) against only 5,812 in the previous year, and extensions aggregating 2,297 miles were approved for construction compared with 810 miles in 1935-36. To construct the new lines authorised and to provide equipment to serve new rural customers required a capital expenditure of $5,743,061, towards which the Provincial Government granted $2,860,010. It is interesting to note that the rural peak load occurs in July or August, chiefly owing to the fact that a large number of summer cottages are served.

Further substantial reductions were made during the fiscal year in the rates to rural consumers. On December 1st, 1936, the service charge to ordinary farm classes was reduced to a maximum of $1.00 per month net, and in August, 1937, this reduction was extended to all hamlet classes, except to summer cottages using electric stoves or other large appliances requiring a three-wire service. The low rates, however, have unquestionably stimulated a demand for the construction of extensions to many areas, the inhabitants of which have not hitherto been able to apply for service.

The total energy generated and purchased by the Commission was 7,750.6 million kWh (6,237.1 million kWh generated) as compared with 6,996.6 million kWh (5832.4 million kWh generated) in the previous year, an improvement of 10.8 per cent. The total peak load was 1,694,406 h.p., an advance of 4.7 per cent.

During the past year development or control of additional supplies of power from sources in Ontario has been arranged for in several localities. In the Georgian Bay system the construction of a new 10,000-h.p. generating station on the Musquash River, the outlet to Georgian Bay from the Muskoka Lakes, was commenced and is to be completed this year. In the Eastern Ontario system the Commission, in November, 1936, approved the purchase of three plants on the Otonabee River, the property of the Canada Cement Co. One factor that has made it practicable to include these small plants in a modern supply system is the advance made in the design of remote control and automatic equipment. To augment the power supply of the Nipissing and Sudbury districts the Commission purchased from the Abitibi Power and Paper Company its 10,000 h.p. plant at Crystal Falls on the Sturgeon River.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Electricity at Denham Studios

THE mansion formerly known as "The Fisheries" situated in the grounds of London Film Productions, Ltd., Denham, has recently been converted into offices and equipped with over 2,000 ft. of tubular heaters, loaded at 60 W per foot. The heaters, which are finished in unobtrusive colours, are disposed throughout the different offices, corridors and halls, &c., in positions both to suit the furnishing of the rooms and to provide the most effective heating. The installation is designed to give a temperature of 65 deg. F. in the offices and 60 deg. F. in corridors and hall when the outside temperature is 30 deg. F. The calculated heat loss of the buildings for the above temperatures is 371,000 B.th.u. per hour. Actually the output of the installation is slightly over 410,000 B.th.u., an average of 1.42 W per cu. ft. for the offices and 0.82 W for corridors, &c.

Radiant type electric fires have also been installed in most of the offices. These are under separate control and provide additional heat which is often required for visitors and staff from warmer climates where the average indoor temperature is usually 70-75 deg. F.

In providing the domestic hot water supply the existing 200-gal. rectangular tank has been fitted with two 6-kW banks of immersion heaters each controlled by a thermostat operating through a double-pole contactor. One reason for installing electric heating in these premises was to improve the running plant load factor on the studio generating plant, the supply being 230 V d.c. between the outers of the 3-wire system. The installation was designed by Capt. J. R. Young, chief engineer of London Film Productions, in collaboration with Unity Heating, Ltd., who were the suppliers of the equipment.

Industrial Birmingham

In the charter centenary celebrations which have recently concluded, Birmingham's civic history received the attention to which its eminence entitled it. While the pageantry of the occasion naturally included an acknowledgement of Birmingham's debt to its manufactures, the tribute was of necessity more concerned with history than current industrial affairs. It is, therefore, appropriate that the occasion should be followed by the publication of a booklet dealing in more extended fashion with the industries which have contributed so much to the reputation which Birmingham enjoys to-day, not only as a successful civic entity, but also as one of the most comprehensive manufacturing areas in the world. Birmingham claims to be the home of 1,500 trades and the booklet illustrates their variety by photography following the clear and intimate example of the cinema, and within its twenty-eight pages over 250 illustrations have been included. The electrical industry of Birmingham is, of course, an important one and a section of the booklet is devoted to electricity and shows in pictures the countless products which are associated with it.

Hull's 20,000th Cooker

An important stage in the history of the Hull Corporation Electricity Department was reached on August 10th when the 20,000th electric cooker was installed in the home of Mrs. J. M. Hakney, of 70, Kilnsea Grove, Southcoates Estate, Hull. The first cooker was installed in 1929, and by 1935 the 10,000 mark had been reached, the further 10,000 cookers to bring the figure to 20,000 being installed in the subsequent two years. To emphasise the importance of the occasion a special campaign was held by the Department. A full-page advertisement, specially prepared and with a photograph of Mrs. Hakney, was inserted in the local Press on the evening of the day the 20,000th cooker was installed, and contained an invitation to the general public to attend a presentation in the Ferensway showrooms to the lady concerned the following day. The presentation, which took the form of a set of aluminium cooking pans, was performed by the chairman of the Electricity Committee (Ald. F. Holmes), and an electric fire was presented by the Simplex Electric Co., Ltd., who supplied all the cookers. Mr. D. Bellamy (general manager of the Corporation Electricity Department), Mr. C. I. Shuttleworth (chief engineer) and Mr. R. Charles (Simplex Electric Co.) were also present. An employé of the Department, Mr. G. F. Hird, who had installed the first cooker and also the 10,000th, had come back from his annual holiday specially to install the 20,000th and to attend the presentation. The lecture

Mr. D. Bellamy (general manager, Hull Electricity Department), addressing a meeting at the electricity showrooms

theatre where the presentation took place was filled to capacity, and complimentary envelopes containing a cookery book and the Department's publicity literature were distributed to all present. The campaign was continued by two men carrying sandwich boards through the streets of the city on August 12th, calling attention to the fact that 20,000 electric cookers had now been installed and pointing out the advantages of electric cooking. A novel touch was obtained when the men engaged for the parade were dressed in chef's uniform. On August 13th the campaign was concluded by a decorated vehicle being drawn round the city. A special window display was also carried out in conjunction with the campaign, embodying slogans and features.

An Agricultural Show Display

The accompanying illustration depicts the attractive and practical stand which Electricity House, Ltd., has been using with considerable success at several of this season's agricultural shows. In the recent Lincolnshire Show the company won the first prize for the best stand. Designed by the company's architect, Mr. R. W. Marsden, the stand has an area of 100 sq. yd., which gives ample room for a comprehensive display of electrical apparatus and fittings. One side of the stand, which is devoted to cooking demonstrations, has a canvas canopy erected in a lean-to fashion to protect the audience in case of rain, chairs being provided under this awning, and as the floor of the stand is raised approximately 2 ft. from the ground a full view of the demonstration is provided for all members of the audience. The stand is built entirely of timber with a canvas roof, and spring draw blinds are accommodated under each facia as a protection against weather and as a means of closing the stand at night. The name of the company is carried out in raised letters on one facia and the remaining three bear the names of some of the associated companies.

A display arranged by Electricity House, Ltd., which has been exhibited at a number of agricultural shows

Ore Conveyor Lighting in South Africa

The lighting of ore picking belts in the gold-mining districts of South Africa has recently been investigated by the British

General Electric Co., Ltd., Johannesburg. It was found that while no two sorting belts were exactly alike it was possible to make general recommendations regarding the lighting which were capable of application to the great majority of cases. The ore dealt with contains a variety of different coloured materials and is always wet when passing over the picking belts. It is therefore desirable to provide a method of illumination which makes discrimination between useless and good ore easy, and at the same time avoids as far as possible reflections in the facets of the rock, and in the wet conveyor belt, in order to reduce eye-strain to the minimum. Investigations showed that daylight during the early morning is of more suitable colour quality than that of the afternoon for sorting and that light from "daylight" blue gasfilled lamps makes discrimination much easier than that from vacuum type lamps which are quite commonly used. These facts suggested that "Osira" electric-discharge lamps might prove suitable on the score of colour, and trials with this type of lamp proved that they are suitable. In view of the very wide variation in intensity provided on the ore during varying conditions of daylight, it was decided, when an actual installation of "Osira" lamps was undertaken, that the intensity of artificial light provided should be sufficient to supplement poor daylight, and make it possible to maintain a minimum illumination of about 160 ft.-candles on the picking belts both by day and night. To meet these requirements special reflectors were designed to house 400-W "Osira" electric-discharge lamps, and to provide an asymmetric distribution of light in order to concentrate the illumination along the conveyor belts as far as possible, while at the same time providing a direct light cut-off well below the horizontal in order to avoid subjecting operatives to direct glare. The final design of reflector arrived at consisted of a sheet-metal housing containing curved frosted silvered glass mirror reflectors to direct the light up and down the length of the belt, and flat opal glass reflectors at the sides. It was found that these reflectors gave satisfactory results when mounted about 4 ft. 6 in. above the belts, and at approximately 10-ft. intervals along the length of each belt, which in some cases exceeded 100 ft.

"Osira" lighting for an ore conveyor belt in a South African gold mine

Since the introduction of this type of lighting, several hundred "Osira" lamps have been installed in various crushing mills in the Johannesburg area.

The Royal Lancashire Agricultural Show

At the recent Royal Lancashire Agricultural Show the Liverpool Corporation equipped a stand in conjunction with the E.C.A., E.D.A. and the E.A.W., on which was displayed a comprehensive selection of electro-farming equipment and agricultural appliances lent by leading manufacturers. The covered stand was divided into four bays, each 35 ft. wide and 60 ft. in length, and the display included a model dairy, agricultural machinery and appliances in motion, household electrical apparatus, and two kitchens, old-fashioned and modern. A new feature was shown illustrating the possibility of growing maize. In a small hut 8 ft. by 6 ft. maize which had already been immersed in liquid was placed on sloping shelves. The liquid was allowed to trickle through the maize from shelf to shelf, the temperature of the hut being maintained at 70 deg. F. During the show period the seed sprouted to a height of 8 in. The Royal Lancashire Society chose to use electricity for cooking and the provision of hot water in connection with the whole of the catering for the president, council and public pavilions, and for the general purposes of the show. The necessary equipment was erected and connected up by the Liverpool Corporation Electricity Department.

A section of the joint display of Liverpool Corporation Electricity Department, E.C.A., E.D.A. and the E.A.W. at the recent Royal Lancashire Agricultural Show

Refrigeration Propaganda at Manchester

An interesting piece of electrical refrigerator propaganda has just been undertaken by the Manchester Corporation Electricity Department. Eleven neighbouring undertakings were invited to co-operate in approaching domestic refrigerator users to ascertain their experiences. Of the 913 questionnaire forms which were distributed 400 were returned. There were nineteen main questions and a number of sub-questions. The return covered sixteen different makes of refrigerators, nearly as many varying sizes, and a wide range of income levels. From the replies received a good deal of interesting information was obtained. For instance, about nine out of every ten owners of refrigerators indicated that they kept them operating throughout the winter, but only 52 per cent. used the "Cold Cookery" book. In reply to the question covering breakdowns, the inquiry revealed that 76 per cent. of the electric refrigerators had never been stopped for even the slightest defect, while 93 per cent. had never been stopped for a serious defect. In view of the fact that some of the refrigerators have been in use for ten years, these results are very gratifying. By a large majority (85 per cent.) it was agreed that the small motor was not a source of disturbance, while 90 per cent. of the users agreed that they had no radio interference from the electric motor. Regarding running costs, 89 per cent. stated that this was negligible.

German Radio Exports

In connection with the opening of the fifteenth Radio Exhibition in Berlin the Institute for Economic Research in its weekly report states that the export trade is hampered by all kinds of difficulties, especially patent rights and quotas imposed by various countries. Nevertheless, the value of the foreign sales increased from 28 million Rm. in 1936 to 34 millions last year. Of the exports only 61.7 per cent. were sent to European countries in the first half of the current year, as compared with 92.2 per cent. in 1933. On the other hand, the exports to Asia advanced from 3.1 per cent. in 1933 to 18.5 per cent. for the first six months of 1938, and those to Central and South America from 3.5 per cent. to 16.2 per cent.

Cable Data

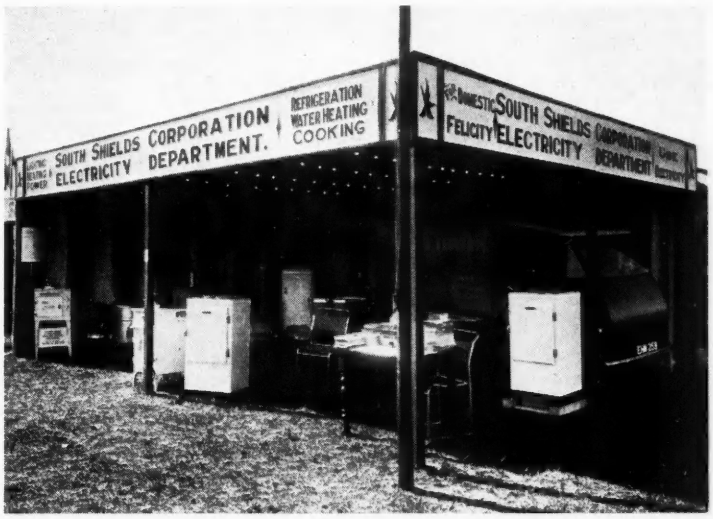
The fourth edition of the general information booklet published by W. T. Henley's Telegraph Works Co., Ltd., contains data concerning insulated cables, overhead conductors, &c. The new edition, which contains considerably more information than earlier editions, has been compiled from the latest available researches relating to the current ratings of the various types of cables under the many conditions of service in present-day practice. The additional data includes various tables of current ratings for rubber insulated cables in accordance with the present edition of the I.E.E. Regulations for the Electrical Equipment of Buildings and the application of the various formulæ and constants to determine cable sizes under the particular conditions existing in actual practice is concisely explained and illustrated by examples relating to the various systems of supply. The table of alphabetically arranged contents in the front of the book has been considerably amplified.

Key Industry Duty

The Board of Trade has received applications under Section 5 (5) of the Finance Act, 1936, for a licence to import free of duty a picture-transmitting apparatus of the type known as the Finch facsimile apparatus comprising a light-beam scanning device and a photo-electric cell receiving the light reflected from the scanned picture. Any representations that similar apparatus is made, or is likely to be made within a reasonable time, in the United Kingdom or elsewhere in the dominions should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, within one month from August 9th, furnishing details of such similar apparatus.

Durham County Agricultural Show

At the recent Durham County Agricultural Show the South Shields Corporation Electricity Department had an interesting exhibit of electric refrigerators, cookers and water heaters. In sending us the accompanying illustration, Mr. N. T. Smith, the borough electrical engineer, states that about 3,000 people visited the stand during the day, and many useful inquiries were dealt with. The electric vehicle shown was also of interest and Mr. Smith says that he has no doubt that there will be a development of the electric vehicle load in the near future.



The South Shields Electricity Department's stand at the Durham Agricultural Show

A Large Railway Contract

The English Electric Co., Ltd., has been awarded a contract for twenty 350-b.h.p. 0-6-0 Diesel-electric shunting locomotive equipments by the London, Midland & Scottish Railway Co. The locomotives will be used for general shunting duties and for intensive hump-shunting purposes. Each locomotive will be powered by an English Electric "6K" type engine, developing 350 b.h.p. at 680 r.p.m., direct-coupled to a d.c. generator. The drive will be through a single traction motor mounted in the superstructure, driving through a jack-shaft to the road wheels. The locomotives will be provided with torque control and mechanical drives to all auxiliaries. It is interesting to note that the L.M.S. has already in operation on its system eleven English Electric 350-b.h.p. Diesel-electric locomotives. The Diesel engines and all electrical equipment will be manufactured by the English Electric Co. at its Rugby and Bradford works, respectively.

Changes of Address

The registered office of the Hendon Electric Supply Co., Ltd., has been transferred from Salisbury House, E.C., to Northmet House, Southgate, N.14.

Alneco, Ltd., has removed to 16, Theodore Street, Birmingham, 19 (telephone: Aston Cross 2424).

Russian Electrical Machinery Imports

A return lately to hand shows that the imports of electrical machinery and allied material into Soviet Russia during the three months ended March last attained a value, converting roubles at 10 to the £, of £2,179,900 as compared with only £871,300 in the corresponding quarter a year ago.

The Woman's Fair and Exhibition

The electrical section of Woman's Fair and Exhibition of Electricity in the Home at Olympia in November will be one of the largest ever staged in this country. The Electrical Development Association has organised a co-operative stand of over 20,000 sq. ft., and among the exhibitors will be Belling and Co., Ltd., Berry's Electric, Ltd., Bulpitt and Sons, Ltd., E. K. Cole, Ltd., English Electric Co., Ltd., General Electric Co., Ltd., Hague and McKenzie, Ltd., Hanovia, Ltd., L. G. Hawkins & Co., Ltd., Hotpoint Electric Appliance Co., Ltd., Hurley Machine Co., Ltd., Jackson Electric Stove Co., Ltd., Moffats, Ltd., Rubery Owen Co., Ltd., and Stokes Appliances, Ltd.

The attractive lay-out of the stand of the Electricity Supply Board, Dublin, at the recent Royal Dublin Society's Horse Show, reference to which was made in our last issue

New Motors for Old

Brook Motors, Ltd., has issued a booklet giving details of a scheme for exchanging new Brook motors for old a.c. or d.c. machines. Although the scheme has only been in operation for a little over two months the company has already exchanged over 1,200 motors.

Hotel Electrical Equipment

Reids Hotel at Funchal, Madeira, which has 120 rooms, is to be equipped throughout with a complete G.E.C. luminous indicator system, as well as G.E.C. conduit, cable, switchgear, switches, switch-plugs, &c. The installation has been entrusted to T. Clarke & Co., Ltd., London, and when completed will be one of the most up to date in the island.

Electricity at a Flower Show

At the recent Worthing Flower Show the Corporation Electricity Department staged an attractive exhibit in Homefield Park. A representative selection of appliances was on view, connected and shown under working conditions, and there were continuous cooking demonstrations which attracted large crowds. Outside the marquee an electrically heated greenhouse and garden frame resulted in numerous inquiries.

Appointments Vacant

Assistant electrical engineer for Kirkcudbright Electricity Department.

Temporary assistants II and III and temporary technical officer in the Admiralty Technical Pool.

Shift charge engineer for London Film Productions, Ltd.

Meter test room superintendent for Barking Electricity Department.

Lady demonstrator for Gillingham Electricity Department.

(See our classified advertisements.)

Prices of Materials

Henry Gardner & Co., Ltd., report, August 17th: Copper bars (best selected), sheet and rod, £76, £2 decrease. English pig lead, £16 2s., 8s. decrease. Spelter, £13 2s. 6d., 16s. 3d. decrease. English block tin, £191 15s., £2 5s. decrease.

Edward Till & Co. report, August 17th: India rubber, Para fine, 7¾d., ¼d. increase.

New Catalogues and Lists

Siemens & General Electric Railway Signal Co., Ltd., East Lane, Wembley.—A leaflet dealing with a single element vane type a.c. time-element relay.

Crossley Bros., Ltd., Manchester, 11.—"Crossley Chronicles" for August, giving details of a 40 b.h.p. Diesel-electric installation in Scotland.

J. H. Sankey & Sons, Ltd., Refractories Dept., Ilford.—A 16-page booklet containing details of "Pyruma," "Siluma," "Aluma," and other fire cements and fire bricks, with natural colour illustrations.

Samuel Osborn & Co., Ltd., Clyde Steel Works, Sheffield.—A 60-page illustrated catalogue of "Evershyne" stainless steel, "Weldshyne" acid-resisting steel, and "Caustenitic" steels.

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—Copies of "Sirocco Contracts," describing air-conditioning installations for sugar refining and packing, and a booklet dealing with heating, ventilating, and air-washing equipment for the Sheffield Corporation.

Lloyds & Co., Ltd., Letchworth, Herts.—A leaflet illustrating the electric "Hedgeshear."

Cooper & Smith, 94, Charlotte Street, London, W.1.—Leaflets relating to "Heley" lighting fittings.

Simplex Electric Co., Ltd., Broadwell Road, Oldbury, Birmingham.—A coloured illustrated catalogue of new season's electric fires.

Herbert Morris, Ltd., Loughborough.—Details of lifting machinery in relation to the new Factories Act.

British Insulated Cables, Ltd., Prescot.—Particulars of the B.1 dual coin prepayment meter, types "M" and "MDT."

Meetings of Creditors

Belshaw & Co., Ltd.—Meeting of creditors on August 31st at 4B, Frederick's Place, Old Jewry, E.C.2.

John White & Sons (Radio), Ltd.—Creditors' meeting on August 19th at 51, Wardwick, Derby.

Private Arrangement

L. P. Hasler, radio and electrical engineer, 21, High Street, Chelmsford.—The creditors met recently at Chelmsford, when a statement of affairs was submitted showing liabilities of £884, of which £641 was due to unsecured creditors and £243 to partly secured creditors. The net assets were £711, leaving a deficiency of £173. The creditors passed a resolution in favour of the estate being administered under a deed of assignment in favour of Mr. C. Latham, accountant, 185-188, High Holborn, London, W.C. A committee was also appointed consisting of Mr. A. Cripwell and the representatives of Murphy Radio, Ltd., and General Electric Co., Ltd.

Bankruptcy Proceedings

W. B. Smithers, 11, Lunt Grove Avenue, Birmingham, lately carrying on business at 11, Oakwood Close, Dartford, Kent, electrical contractor.—At the public examination held recently at the Court House, Eastgate, Rochester, debtor said his failure was due to inexperience, lack of capital, losses on contracts, and rising costs of materials. His liabilities amounted to £670, with assets of £13, leaving a deficiency of £657. The examination was closed subject to the signing of the notes.

J. A. Whiteman, 4, Northfields, Kilburn, Derbyshire, lately trading as Northfield Radio, wireless dealer.—The first meeting of creditors was held on August 9th at the Official Receiver's Office, 22, Regent Street, Park Row, Nottingham, when debtor attributed his present position to lack of capital, losses sustained on the resale of goods recovered from defaulting hirers, bad trade, lack of business knowledge, and ill-health. No statement of affairs was lodged and the matter was left in the hands of the Official Receiver as trustee.

W. N. Smith, 18, King Street, Dudley, wireless dealer.—At the public examination held recently at Dudley, the debtor stated that he previously worked in the radio department of his father's business. He subsequently purchased this branch from his father, the businesses being conducted in adjoining premises. During the first season, 1934-35, trading proved successful, but later declined, and it was to this that he attributed his failure. According to his statement of affairs there were ranking liabilities of £576 and assets of £89. The examination was concluded.

L. G. Baker and **C. Silva-White,** trading as L. Baker & Co., 21, Brentgovel Street, Bury St. Edmunds, and at Mildenhall, Ely, and Elmswell, and as L. Baker White & Co., Stowmarket, radio and electrical dealers. (Separate application of C. Silva-White.)—The application for discharge was heard on August 9th at Bury St. Edmunds, when it was reported that the failure occurred in 1936 and the creditors in the joint estate had received 13s. 10d. in the £. His own creditors received 20s. in the £, but his partner's only received 7d. in the £. The discharge was granted subject to seven days' suspension.

C. H. Chadwick, wireless dealer, Mill Road, Cromer.—Public examination September 27th at the Shirehall, Norwich.

A. S. Deacon (London Wireless Co.), radio dealer, 32, London Road, Derby, and 127, Pear Tree Road, Derby.—Discharge suspended for four months until November 6th, 1938.

N. Hall, wholesale and retail radio dealer, trading as "Hall & Co.," at 66, Margaret Street, Ashton-under-Lyne, and as "Horners" at 278, Stamford Street, Ashton-under-Lyne.—Trustee, Mr. F. E. Bendall, 31, Lloyd Street, Manchester, released July 7th.

J. T. Townson, radio and electrical engineer, 97, Market Street, Dalton-in-Furness. Receiving order made August 9th on debtor's own petition.

W. Smith and **A. G. Smith** (W. Smith & Son), radio and electrical engineers, 23, Crescent Street, Weymouth.—Last day for receiving proofs for dividend August 26th. Trustee, Mr. H. T. Jones, 12, Rolleston Street, Salisbury, Official Receiver.

A. C. Dobbing and **A. Ll. Rothery** (Ripon Electrical Co.), electrical engineers, 39, Kirkgate, Ripon.—Last day for receiving proofs for dividend August 27th. Trustee, Mr. W. A. Kay, Lantern Tower Chambers, Coppergate, York, Official Receiver.

R. R. French (Radio Electrical Services), radio dealer, Chandos Place, St. Austell.—First and final dividend of 1s. 0½d. in the £, payable August 13th at 12, Princes Street, Truro.

Company Liquidations

Newquay Electric Light & Power Co., Ltd.—Meeting September 9th at Thames House, Millbank, S.W.1, to receive an account of the winding-up by the liquidator, Mr. E. J. Harrison.

Porlock & District Electric Supply Co., Ltd.—Meeting September 9th at 53, Parliament Street, Westminster, S.W.1, to receive an account of the winding-up by the liquidator.

Kings Norton Electrical Co., Ltd.—Meeting September 15th at King Edward House, New Street, Birmingham, to receive an account of the winding-up by the liquidator, Mr. F. E. Bendall.

Mersey Electrics, Ltd.—Meetings September 29th at 43, Regent Street, Wrexham, to receive an account of the winding up by the liquidator, Mr. A. K. Jones.

Information Department

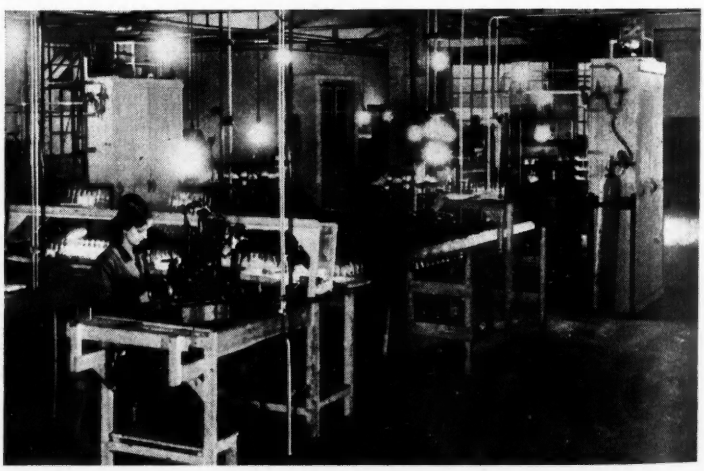
GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

KERAFAR insulating material.
INVICTA sewing machine.
GLASMOIRE glassware.
LYDIA water heater.
Lamp for meat sterilisation.

Up-to-date Lamp Production Methods

THE methods employed in the production of the modern electric lamp have become so standardised that it is mainly in matters of detail that any differences in the manufacturing processes in the individual factories are noticeable. Two things impressed us particularly during a recent visit to the works of Tungstalite, Ltd., at Hackney. One was the careful layout of the plant to ensure not only the most profitable use of the space available but also a steady flow of work throughout the factory. The other was the precautions taken at every stage of manufacture to guard against wastage of material and the despatch of faulty products. The works, which have a total floor space of about 50,000 sq. ft., occupy three buildings and comprise separate departments for raw materials (all British), wire drawing, filament coiling, life testing and photometry, mass-production assembly, assembly for sundry and special lamps, stores and despatch.



A corner of the lamp-assembly department at the works of Tungstalite, Ltd., Hackney

The first stage in the wire manufacture is the production of pure tungsten powder. By means of a hydraulic press, the latter is pressed into long thin bars of uniform size and weight. The bars are first annealed in a tube furnace and they are afterwards gradually heated to intense incandescence by the passage of a low-voltage current of several thousand ampères. The whole apparatus is water cooled, the process being carried out in a stream of pure hydrogen. The current input is controlled by a transformer choke, the peak current being limited so as to avoid the melting of the bar which would otherwise fuse at a temperature of 3,400 deg. C. The sintered bar now passes on to the swaging machines after which the metal is drawn down through diamond dies, each bar yielding about 10,000 metres of fine filament wire. The coiling of the latter is subject to careful scrutiny and so that no imperfect specimens escape detection every filament is separately examined before issue to the assembly department.

It is here that the careful planning and timing of the production is most noticeable, the whole course of manufacture from the making of the stem to the final testing being effected as a continuous process with a minimum of manual handling. A novel space and time-saver has been produced by the company in the form of a combined photometer and ageing machine. Every lamp is thereby tested and approximately measured, facilities for precision photometry and life test being provided in a separate department. All gas for filling lamps is carefully purified and tested, and high-frequency coils are used for vacuum indicators, while the presence of strain or stress in the glass is detected by viewing the bulbs under polarised light.

A remarkable feature of the storage department is that although it contains several hundreds of thousands of finished lamps there is not one to be seen. Storage boxes have been eliminated and instead the lamps are placed in enclosed cupboards on perforated plywood tryas which take up next to no space when not in use. Before despatch every lamp is tested again, and is subjected to a final cleaning process which is now effected on a new type of lamp-polishing machine, designed by the company's staff.

Electricity Supply

Lighting, Domestic, Power

Aberystwyth.—CHANGE-OVER.—The cables recently laid and jointed in Aberystwyth by Ismay Cables, Ltd., in connection with the change-over, were tested and put into commission last week. To commemorate this a dinner was held at the Belle Vue Hotel, Aberystwyth, those present including the Mayor (Mr. J. Barclay Jenkins), and Messrs. F. T. Foulkes (chairman of the Electricity Committee), E. P. Perkins (borough electrical engineer), A. Watson (deputy borough electrical engineer), W. R. Hall (managing director of Ismay Cables), E. Martin (contracts manager of Ismay Cables), T. Scott Harrison (B.T.H.), C. A. Smiles (English Electric Co.), and J. Lee and H. G. Spencer (Ismay Cables). Mr. Hall welcomed the guests and the Mayor responded. Messrs. Foulkes, Perkins and Watson also spoke.

Adwick-le-Street (Yorks).—STREET LIGHTING.—The Urban District Council is considering a scheme for lighting the Great North Road at Woodlands by means of centrally placed mercury vapour electric-discharge lamps at a cost of £1,859. The matter is to receive further attention after a visit has been paid by members of the Council to the B.T.H. works at Rugby.

Ashton-under-Lyne.—METER RENT.—The Electricity Committee is to institute a meter rent of 1s. a quarter, commencing with accounts rendered from November 1st next.

PRIVATE PLANT INSTALLATION IN INSTITUTION.—The Lancashire Public Assistance Committee has decided to install generating plant at the Institution. The cost, including the remodelling and augmentation of the existing cables, wiring, etc., will be £8,100.

Belgium.—SIX MONTHS' POWER OUTPUT.—The output of the power stations in Belgium during the six months ended June last amounted to 2,598,941,816 kWh. During the half-year six comparatively small generating plants were closed down, the supply to the districts affected being taken over by the large interconnected stations.

Cardiff.—NEW PLANT.—The Electricity Committee is to interview the Electricity Commissioners with regard to the proposed purchase of new plant for the Roath power station.

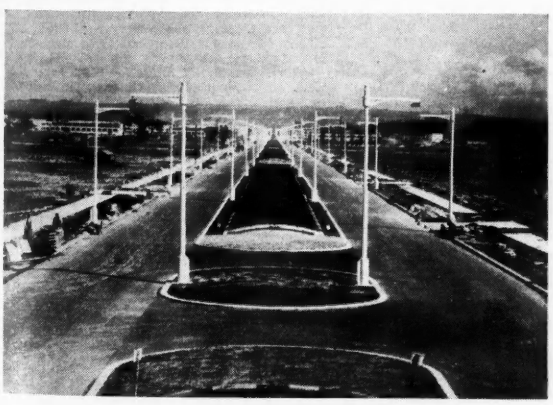
Czechoslovakia.—POWER RESOURCE SURVEY.—Announcing the results of a survey of water-power resources in Czechoslovakia, the Ministry of Public works points out that only about 20 per cent. of the existing water-power resources have so far been utilised for the production of energy. Total possibilities are estimated at about 1,200,000 kW. Nearly half of this capacity is in Slovakia, where resources are estimated at 532,000 kW. In Bohemia the resources are estimated at 420,000 kW.

Easington.—STREET LIGHTING.—The Parish Council has obtained sanction to borrow £2,000 for street lighting.

East Ham.—ANNUAL REPORT.—In the Electricity Department's area there are 31,332 consumers, 1,017 having been added during the past year. Of these 16,380 have taken installations on the rental scheme, 2,578 of the consumers finally purchasing the installations. There are 3,622 cookers and 1,661 water heaters on hire, 1,322 of the latter having been added during 1937. Mr. W. R. Elliott, the engineer and manager, says that there was a drop of 105,385 kWh in the power sold for traction owing to the cessation of tramway services on the Wanstead and Royal Albert Docks route.

Faversham.—NEW FEEDER.—Owing to the large increase in the use of electricity during the past year, the Town Council is to take steps to lay a new feeder cable to relieve existing cables.

Gateshead.—STREET LIGHTING.—The Town Council is to light Valley Drive with 250-W mercury-vapour discharge lamps at a cost of £720.



The lighting arrangements at Kingsway, Gateshead

CABLES.—The North-Eastern Electric Supply Co., Ltd., is to lay 20,000 and 6,000-V underground cables in Durham Road and a low-voltage cable across Beaconsfield Road to a sub-station. Low-voltage cables are also proposed in Inskip Terrace, Northbourne Terrace, Raby Street and Back Durham Road.

LIGHTING OF TRADING ESTATE THOROUGHFARE.—The accompanying photograph sent to us by the Metropolitan-Vickers Electrical Co., Ltd., illustrates the new lighting arrangements in the main road, Kingsway, running through the Team Valley Trading Estate, Gateshead. There are 360 "Metrovick Kingsway" lanterns, incorporating 400-W horizontal "Metrovick" mercury discharge lamps.

Hampshire.—SUPPLY TO POLICE STATIONS.—The County Council is to install electricity at Alton police station, Alton police court, Lymington police station, and Ringwood police station.

Hornsey.—A PROGRESSIVE UNDERTAKING.—As the greater part of the borough is supplied in bulk by the C.E.B. it has been expected that instructions would be issued for the closing down of the generating plant. It appears, however, from the annual report of Mr. F. C. Orchard, the borough electrical engineer, that the plant may be required for A.R.P. schemes for some time to come. Of the total services connected (17,871) 14,923 are on d.c. and the change-over to a.c. is proceeding steadily, 2,272 having been completed during the year. In addition, 1,135 new services were laid. An interesting fact brought to light is that as a result of experience in the use of electrical domestic equipment gained by girls at school a number of appliances have gone into parents' homes. At the beginning of the year the new a.c. meter testing house came into full operation and engineers from all over this country, and even Australia and South Africa, have paid visits as a result of reports published in the technical Press. During the year two cooker hire schemes were introduced and a hire scheme was also initiated for water heaters, radiators and wash boilers, and simultaneously all-in contract tariffs were introduced for both domestic and industrial purposes. Nearly 18 miles of principal roads are being lighted by sodium electric-discharge lamps; the contract for sodium equipment and special remote control apparatus is said to be the largest ever placed in this country.

Ipswich.—SATISFACTORY YEAR.—Mr. H. E. Blackiston, borough electrical engineer, reports a satisfactory year with an increase of 13 per cent. in kWh sold and an increase of 1,080,882 kWh (18½ per cent.) in the bulk supply to Felixstowe and East Suffolk. The average price received continues its downward trend from 0.987d. to 0.967d. per kWh, and the number of consumers rose by 2,180 to 24,804, partly due to the transference from non-consuming slum-clearance dwellings to new estates. Actually saturation point will soon be reached, nearly 84 per cent. of the houses being connected already.

Kettering.—THUNDERSTORM CAUSES SUPPLY INTERRUPTION.—The most serious supply breakdown ever experienced by the Electricity Department occurred during a severe thunderstorm on August 11th, when nine sets of fuses were blown and some dozen villages were without electricity. The first signs of trouble were at 10 p.m. and it was not until 3 a.m. on the following morning that the supply was restored.

Lancaster.—ELECTRICITY IN AGRICULTURE.—The city electrical engineer has reported to his committee on experiments which he has been conducting with a view to testing the possible uses of electricity for heating purposes in connection with agriculture. The experiments have now reached the stage when a commercial test is required. The committee has sanctioned an arrangement to supply a horticulturist with the necessary gear, which will be bought from the Corporation if the test proves a success. The electricity will be supplied at the restricted hour tariff rate.

FURTHER ELECTRICAL WORK.—The city electrical engineer estimates that works required to be executed during the next five years will cost £179,500. These include the laying of extra-high-voltage lines and low voltage feeder network; extension of North Road premises, to include offices, showrooms, meter testing room, and stores, and the reconstruction of the sub-station; separation of switchgear at Caton Road generating station; and an extra-high-voltage feeder from Ridge Lane *via* County Mental Hospital and Newlands Lane to Bailrigg.

Leicester.—PRECIPITATION AT POWER STATION.—A 275-ft. high electrostatic precipitator is in course of erection around one of the chimneys at the generating station, Aylestone Road, Leicester.

An Underground Sub-station Contract

The London Passenger Transport Board has placed a £37,000 contract with the Metropolitan-Vickers Electrical Co., Ltd., for the supply of motor-generators and switchgear for twenty-one new sub-stations now under construction, ten on the North London and eleven on the North-East London Railway extensions. In view of the greater immunity from interference from stray currents arising from the lighting or power supplies, which usually have a frequency of 50 cycles, in accordance with the national standard, the Board has decided to continue its present practice of using a frequency of 33⅓ cycles for signalling purposes. The motor generators are required to change the frequency of the power supply to the signalling frequency.

Leigh (Lancs).—REDUCED CHARGES.—In addition to the revised prepayment meter rates already published the following reductions in charges have been made, states Mr. J. B. Hudson, the electrical engineer and manager. Maximum demand system: 6d. (instead of 7d.) for the first hour's use per day at the m.d. rate, and ½d. (¾d.) for all in excess. All-in load rate prepayment meter system, where appliances of over 750 W are used: 3½d. (4d.) per kWh up to 400 W demand and ½d. (1d.) where the demand exceeds 400 W. The 10s. fixing charge for the installation of water heaters has been discontinued.

Leyland.—ELECTRIC DISCHARGE LAMPS.—The Council has decided to install 150-W mercury-vapour lamps along the road from the Old Cross at Leyland to the boundary at Farington. The cost will be £1,250.

Liverpool.—LIGHTING THE CITY.—Progress in every direction is reported by Mr. P. J. Robinson, the city lighting engineer, in his annual report of the activities of the Lighting Department. Streets, courts and passages lighted now total 951 miles, as compared with 941 miles in 1936, and during the year there has been an increase of 21½ miles in electrically lighted streets and a decrease of 12 miles of gas lighting. The increase in the number of lamps is 586, bringing the total to 32,575. Of these 5,320 electric lamps are operated from 27 control points by superimposing a high frequency current on the main. It is surprising to learn that over £500 has to be spent per annum in making good wilful damage to lamps.

London.—HACKNEY.—Mr. E. A. Mills, the borough electrical engineer, in his annual report, states that although the C.E.B. found it necessary to continue to shut down the generating station during the night, the station was first in order of coal consumption and thermal efficiency throughout the whole of the country in the group of stations having an output of between 100 and 200 million kWh per annum. The total working cost per kWh sent out was 0.2092d. in 1937 (0.1887d. in 1936). An increase of 30 per cent. is reported in sales of electricity for domestic purposes.

Morecambe.—ILLUMINATIONS.—The autumn illuminations will commence on August 26th and continue until October 10th. Among the set pieces will be "Snow White and the Seven Dwarfs," "King Neptune," and "St. George and the Dragon." A total of £30,000 has been spent. "King Neptune's Court" will be held in the open-air bathing pool, where the special lighting effects alone have cost £3,000.

Portland.—SAFETY IN THE HOME.—The Council's electrical engineer considers that the general standard of wiring should be raised and the regulations more strictly adhered to, particularly with regard to earthing. There are cases where baths are installed in kitchens with electrical apparatus and cooker control units with two-pin plugs, and he recommends that these be altered in line with the latest regulations, and also that all cooker earthing connections should be inspected and renewed where necessary. The Electricity Committee has decided that contractors should be required to carry out wiring installations in accordance with the instructions of the electrical engineer and that no such work should be given to any contractor unless he agrees to comply strictly with these instructions.

Raunds.—SUPPLY FOR COUNCIL ESTATE.—Electricity is to be installed in thirty-four houses in course of erection on the Raunds Urban District Council's Crow Spinney housing site.

Redcar.—FUTURE OF FRINGE ORDER DISTRICTS.—Representatives of the North-Eastern Electric Supply Co., Ltd., have been interviewed regarding the taking over of the distribution cables, services, meters, etc., in connection with distribution to consumers within the area of the Fringe Orders. The North Eastern Electric Supply Co., Ltd., is to submit a formal offer shortly, when the matter will further be considered.

Shipley.—DISCHARGE LAMPS.—Mercury electric-discharge lamps are to be installed in various roads at a cost of £2,230.

FREE SERVICE CABLE.—The Electricity Committee has decided not to charge for laying the first 30 ft. of service cable to premises.

Sparshot.—PUBLIC SUPPLY FOR INSTITUTE.—The Hampshire Agricultural Committee is to change over the Agricultural Institute installation to the public electricity supply. Estimates show that economies will be effected in labour, maintenance and renewal costs.

Stockton-on-Tees.—ANNUAL REPORT.—Mr. S. G. Marston, borough electrical engineer, reports that in 1937-38 there was an increase of 415 in the number of cookers connected, bringing the total to 1,310. This had a corresponding effect on the sales of electricity for domestic purposess, an increase of 687,065 kWh bringing the total to 3,131,727. There was also an increase of over half-a-million kWh sold for power purposes.

MAINS AND SERVICES.—The Town Council is applying for sanction to borrow £15,000 for mains and services.

Straits Settlements.—SINGAPORE.—The annual report of the municipal electricity undertaking, sent to us by Mr. E. W. P. Fulcher, the electrical engineer and manager, shows an increase in the amount of electricity sold from 37,918,079 kWh in 1936 to 41,877,790 in 1937. Of this, power constituted about 57 per cent. and lighting 35 per cent. The total revenue was $2,821,473 ($2,535,368 in 1936) and the net surplus was $471,248. The load factor (excluding the Coronation, which brought it down to 36½ per cent.), was maintained at 40 per cent., and coal consumption per kWh was slightly reduced to 1.73 lb.

Sub-stations.—The Sunderland Town Council proposes building three new sub-stations. Two will be situated in the East End and the other near the new Eye Infirmary. The cost, including equipment, buildings, &c., will be £11,696.

A site is being obtained in Church Road by the Stockton-on-Tees Town Council for a sub-station.

Steyning Electricity, Ltd., is to erect a sub-station near High Street, Henfield.

The Burton-on-Trent Electricity Committee is to erect a sub-station in Walford Road, Rolleston, and the Barrow-in-Furness Electricity Committee is seeking sanction to borrow £5,000 for sub-station plant.

The Eston Electricity Committee is to acquire a site for a sub-station required for supplying electricity to houses at North Lackenby. Extensions to sub-stations at Cardiff are to be carried out at a cost of £2,676. The Midland Electricity Corporation is to erect a sub-station in High Park Crescent, Sedgley.

Ullswater.—CABLES.—The controversy over the placing of poles for overhead lines on the shore of Ullswater near Howtown, Martindale, has again arisen, and the North Westmorland Rural District Council has decided that the lines must be placed underground.

West Ham.—ANNUAL REPORT.—The increased price of coal brought generation costs up to 0.403 per kWh in 1937, states

The World Power Conference

Sectional Meeting in Vienna

AS we have already reported a Sectional Meeting of the World Power Conference is to be held in Vienna from August 25th to September 2nd. Details of the programme and some of the electrical papers were given in our issue of May 27th (p. 787). We now learn that Mr. Harold Hobson, general manager of the Central Electricity Board, is to be chairman of the technical session in Section D, "The Supply of Energy for Public Lighting."

Mr. C. H. Gray, secretary of the World Power Conference, has sent us a complete list of the United Kingdom delegates and has included a few other British representatives who will attend the meeting. We reproduce the list below:—

Mr. W. J. Bache (chief electrical engineer, Cheltenham), Mr. A. W. Barham (chief electrical engineer, Watford), Mr. J. I. Bernard (British Electical Development Association), Mr. F. M. Birks (Gas Light and Coke Co.), Mr. F H. Brewster (Australian Committee on Large Dams), Mr. A. J. Broughall (L.M.S. Railway), Major F. J. Bywater (comptroller, South Metropolitan Gas Co.), Mr. C. A. Cameron Brown (British Electrical and Allied Industries Research Association), Captain J. C. Chaytor, Mr. T. M. Climie (electrical engineer, Falkirk), Mr. W. N. C. Clinch (borough electrical engineer, Brighton), Mr. A. C. Cramb (director, British Electrical Development Association), Mr. W. Dieterichs (Gas Light and Coke Co.), Mr. Robert Dowson (C. A. Parsons and Co., Ltd.), Mr. R. C. G. Fennell (Fennell Green and Beilby, Wakefield), Mr. D. Z. de Ferranti (Ferranti, Ltd.), Mrs. G. Z. de Ferranti, Mr. V. Z. de Ferranti (chairman, B.E.A.M.A.), Dr. C. C. Garrard (General Electric Co., Ltd.), Mr. J. A. Gatti (director, Central London Electricity, Ltd.), Mr. N. G. Gedye, O.B.E. (British Committee on Large Dams), Dr. H. F. Gillbe Ministry of Transport), Mr. C. H. Gray (secretary, World Power Conference), Mr. B. Handley (city electrical engineer, Portsmouth), Sir Harold Hartley, C.B.E., F.R.S. (chairman, World Power Conference; chairman, Fuel Research Board, etc.), Mr. F. A. Harper (L.M.S. Railway), Miss C. Haslett, C.B.E. (director, Electrical Association for Women), Mr. Harold Hobson (general manager, Central Electricity Board), Mr. Ernest Hogben (India), Dr. H. Hollings (chief gas chemist, Gas Light and Coke Co.), Mr. J. C. Hosken (Industrial Gas Information Bureau), Mr. A. Howell (Merz and McLellan), Mr. C. C. Inglis (Merz and McLellan), Mr. S. W. Jones (Australia), Mr. W. J. Jones (manager, Lighting Service Bureau), Mr. J. M. Kennedy, O.B.E. (deputy chairman, Electricity Commission), Councillor G. H. Kitson (chairman, Leeds Gas Dept.), Mr. Stephen Lacey (Gas Light and Coke Co.), Mr. H. C. Lamb (chief electrical engineer, Manchester), Mr. B. H. Leeson (A. Reyrolle and Co., Ltd.), Dr. W. L. Lowe Brown (British Committee on Large Dams), Mr. W. E. Maclean (Australian Committee on Large Dams), Mr. C. W. Marshall (Central Electricity Board), Mr. G. H. Nelson (chairman and managing director, English Electric Co.), Mr. H. G. Nelson, Sir Archibald Page (chairman, Central Electricity Board), Mr. C. Parker (managing director, Central London Electricity, Ltd.), Mr. L. C. Penwill (director, Electrical Contractors' Association), Mr. Cecil Phillips (British Thomson Houston Co.), Mr. H. L. Pirie (chief engineer, Coal Utilisation Council), Mr. F. D. Playford, Mr. J. G. Potts (borough electrical engineer, Bury), Mr. T. Rich, O.B.E., Mr. T. P. Ridley (Newcastle-on-Tyne Gas Co.), Dr. E. G. Ritchie (Ruths Arca Accumulators, Ltd.), Mr. H. G. Ritchie (gas engineer, Falkirk), Mr. C. Rodgers, O.B.E. (hon. secretary, British National Committee, W.P.C.; deputy-director, B.E.A.M.A.), Mr. E. Seddon (city electrical engineer, Edinburgh), Mr. John F. Shipley (Mackness and Shipley), Dr. F. S. Sinnatt, C.B., F.R.S. (director of Fuel Research, D.S.I.R.), Mr. T. C. Swallow (South Africa), Mr. R. E. Trevithick (La Mont Steam Generator, Ltd.), Mr. J. N. Waite (Central Electricity Board), Dr. C. M. Walter (Birmingham Gas Dept.), Mr. F. H. Whysall (city electrical engineer, Belfast), Mr. C. F. Wood (South Africa), Dr. L. A. Woodward (Fuel Research Station, D.S.I.R.), Mr. H. T. Young (Troughton and Young).

Mr. J. Townley in his annual report. Considerable increases (22 per cent.) were obtained in the domestic consumption, and 2,214 cookers and 2,312 water heaters were connected during the year, and 12,804 consumers out of a total of 49,183 domestic consumers now employ electricity for cooking. Of the 4,136 kW increase in connected industrial load, 1,600 kW is accounted for by constructional works in connection with the L.N.E.R. electrification scheme, while the conversion of the London Passenger Transport Board's tramways to trolley-bus operation has resulted in an increase in output of 1½ million kWh. Of the £73,000 surplus, £23,880 was granted to rate relief.

West Hartlepool.—SUPPLY TO PROPOSED AIRPORT.—The Town Council has reached agreement with the North-Eastern Electric Supply Co., Ltd., regarding an electricity supply to the airport site. The agreement provides that the Corporation should pay £1,234 for a high voltage cable and also provide a sub-station. In the event of the cable being required to supply other properties the supply company will refund the Town Council £450.

Communications

Great Britain.—TELEPHONE CABLE TO CHANNEL ISLANDS.—The first submarine telephone cable between England and the Channel Islands was completed last week when 34 miles of cable, weighing more than 300 tons and laid from a cove near Dartmouth, was joined to a similar length laid from Guernsey.

WIRELESS LICENCES.—During July 342,903 wireless licences were issued by the Post Office, a net increase of 19,438 during the month and 391,900 during the year, bringing the total in force to 8,661,500.

India.—NEW SHORT-WAVE STATION.—The fourth and last of the short-wave stations included in the present programme of radio expansion in India will be opened at Calcutta on August 16th. It is intended to serve Bengal, up to a distance of 500 miles, and will work on a 60-metre wavelength during the night and 31-metre wavelength in the daytime. The waveband has been accepted as most suitable for tropical and semi-tropical latitudes. The short-wave stations at Bombay, Madras, Calcutta and Delhi provide a service for the whole of India, but fading on the short waves makes it difficult for cheaper receivers to pick up the programmes. For that reason in certain of the larger towns medium-wave transmitters are also in existence or under construction, it being proposed to open 5-kW medium-wave stations at Trichinopoly and Dacca. This will probably take place in December and March respectively.

Italy.—RADIO COMMUNICATION ON RAILWAYS.—In the mountainous districts of Italy it frequently happens in winter that the usual telegraph and telephone communication between railway stations is interfered with by heavy falls of snow. In order to overcome this difficulty the Italian State Railway authorities have fitted the trains and stations in such areas with radio transmitters and receivers. In a recent issue of the *Revista Tecnica delle Ferrovie Italiane* Signors Dorati and Pacetti give particulars of the tests of the different forms of instruments and of the type finally decided upon for the particular purpose.

United States.—RADIO COMMUNICATION WITH VAN DRIVERS.—According to the *Electrical World*, a special radio transmission station has recently been set up by the Detroit Edison Co., of Detroit, for the purpose of issuing instructions to the drivers of its fleet of service motor vans. The installation is intended only for one-way transmission, the vehicles being equipped only with receivers which are permanently tuned to the issuing station. Selective signalling makes it possible to call one or any number of the vans.

Traction

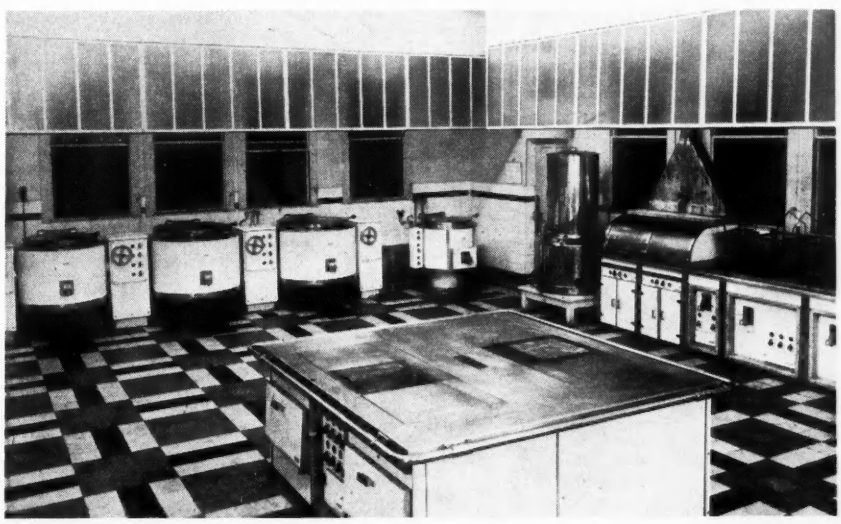
France.—THE LAST PARIS TRAM.—The road transport of Paris has now been completely converted to motor-bus operation, the last tram having run on the route from Le Raincy to Montfermeil.

Ipswich.—SUCCESSFUL TROLLEY-BUS OPERATION.—The sucessful operation of the trolley-bus undertaking continues, and last year the number of passengers increased from 13,918,209 to 16,549,119 and the bus mileage from 2,110,214 to 2,334,677 (10½ per cent.). Many new double-deck buses have been placed in service and new routes operated. A net deficit of £2,342 results from the deduction of a surplus of £1,108 on the trolley-bus account for the year's contribution of £3,450 to the old tramway debt. The income totalled £103,154 (£92,156) and working expenses £87,269 (£76,574). Mr. H. E. Blackiston is the transport manager.

Cooking in a French Hospital

A COMPLETELY electrified kitchen has recently been installed by Alsthom to serve the eight hundred patients at the Fains Les Bains Mental Hospital in the Meuse Department. All the apparatus has been arranged around the walls of the room, with the exception of a large range in the centre. This has two radiant hot-plates for cooking which requires high temperatures, and four plates in which the heating is unevenly distributed, so that by moving the saucepans about on them any desired temperature can be attained. On two sides of this range are provided four small roasting ovens, each with a floor space of about 5 sq. ft.

On entering the kitchen, the first apparatus to be seen on the right is a warming cabinet and a double-deck pastry oven. Next come two stainless steel vats, with a capacity of about 16 gals. of oil each, for frying fish, and also a smaller frying vat with a capacity of just over 4 gals. Armoured type "Calrod" heating coils are immersed in the oil. Two grillers, with "Calrod" elements cast in iron bars forming a single block, have their temperature so regulated that the meat will be well browned on the outside and underdone inside, without burning the meat or fat. A 45-gal. coffee percolator is designed to heat the water rapidly and then maintains it at boiling point until it has filtered through the coffee.



The all-electric kitchen at the Fains les Bain Mental Hospital

On the rear wall of the kitchen is the apparatus for stewing. In a 33-gal. double boiler used for heating milk the heating takes place through a water jacket which separates the milk vessel from the heating elements. The water in this jacket can be made to circulate so that after being heated the milk can be cooled down by water circulation. A small emulsifier placed inside the milk vessel prevents the formation of scum. Four other cooking vessels, two of 66 gals. and two of 44 gals. capacity, have twelve and nine different heating speeds respectively.

The third side of the kitchen is occupied by two large frying pans covering a floor area of about 5 sq. ft. each. These are of cast-iron and have six heating speeds. A low table provides space for a series of small electrically heated utensils (2-4 gals.) in which small quantities of special foods can be prepared. When the kitchen was equipped the hospital authorities took advantage of the opportunity to install electric water heaters for the existing shower-baths.

Feeding the kitchen is a sub-station containing two 150-kW transformers, all the electricity being bought at bulk supply rates. In order, however, to minimise costs, a signal lamp and a bell in the kitchen indicate when the time switch changes over from day to night rate, so that the cooks can as far as possible take full advantage of the cheaper night rate.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aldershot.—September 6th. Electricity Department. Two 300-kVA transformers and one four-panel 6,600-V switchboard. (August 5th.)

Argentina.—September 20th. Buenos Ayres Western Railway, Ltd. Rectifier equipments for traction sub-stations. (August 5th.)

Auchtermuchty (FIFE).—Town Council. Electrical work at housing estate. L. A. Rolland, architect, 47, High Street, Leven, Fife.

Australia.—VICTORIA.—August 30th. State Electricity Commission. Voltage regulating equipment. (T.Y. 24462/38.)*
September 6th. State Electricity Commission. 22-kV outdoor switchgear and accessories. (T.Y. 24850/38.)*
MELBOURNE.—September 6th. Posts and Telegraphs Department. Cable. (T. 25622/38.)*
September 13th. Telephone plugs and sleeves. (T.25673/38.)*

Birmingham.—October 3rd. Public Health and Maternity and Child Welfare Committee. General electrical engineering and engineering services and boiler plant in connection with extensions at Selly Oak Hospital and Infirmary. (July 29th.)

Bute.—August 27th. County Council. Heating and electrical installations at new primary and advanced school at Lamlash, Arran. Wm. Grant, Clerk to Education Committee, Rothesay.

Chester.—August 20th. Supply and erection of installation at the County Hospital, Clatterbridge. F. A. Browne, county architect, The Castle (deposit £10).

Chile.—SANTIAGO.—September 7th. Maritime Works Department. Two electric cranes for the Port of Iquique. (T.Y. 25414/38.)*

Crook and Willington.—August 26th. Electricity Department. 300-kVA transformer, 20,000-V cables and necessary switchgear. (August 12th.)

Darlington.—North-Eastern Joint Board for the Care of the Mentally Defective. Electrical work in connection with the recreation hall at the Prudhoe Colony. Mr. H. Hopkins, Clerk, 11, Houndgate.

Devon.—August 27th. County Council. X-ray equipment at the Hawkmoor sanatorium, Bovey Tracey. Clerk to the County Council, The Castle, Exeter.

Dublin.—August 31st. Electricity Supply Board. Annual supply of tools. (August 5th.)

Dundee.—August 27th. Works Department. Three sets of electrically operated centrifugal pumps suitable for unscreened sewage. Specifications, &c., from D. B. McLay, city engineer, 21, City Square; tenders to Town Clerk.

Eccles.—August 29th. Public Health Committee. Installaion of electric light wiring and fittings in 158 houses in course of erection at Worsley Road, Higher Croft and Peel Green Road. Town Clerk, Town Hall (deposit £1 1s.).

Edinburgh.—September 22nd. City Council. Branch flues for Portobello power station. (August 5th.)

Eston.—September 1st. U.D.C. Steel kiosk sub-station with one 25-kVA transformer and h.v. and l.v. switchgear at North Lackenby, Grangetown. Electrical Engineer, Council Offices, Grangetown-on-Tees.

Fife.—August 23rd. County Council. Electric lighting at Pittenweem Police Station, and electrical work at the Welfare Clinic, Markinch. Schedules (£1 1s. in each case) from Mr. G. Sandilands, County Master of Works, County Offices, Kirkcaldy.

Fort William.—September 7th. Electricity Department. Switchgear, transformers, e.h.v. (transmission) and m.v. (distribution) systems, underground (cable) and aerial construction, e.h.v. and m.v. cable interconnection and earthing arrangements for sub-station, meters and meter-testing equipment, and changing over consumers' existing apparatus. (August 5th.)

Glasgow.—August 25th. Corporation. Electrical installation at Deanston Drive estate (128 houses). Town Clerk, Room 36.

Heston & Isleworth.—August 26th. Electricity Department. One sheet steel kiosk, e.h.v. switchgear and 600-kVA transformer, 11-kV cable and pilot cable. (August 12th.)

India.—SIMLA.—September 6th. Indian Stores Department. Electricity meters for twelve months. (T. 24802/38.)*
Bare copper wire for the year ending January 31st, 1940. (T. 25612/38.)*

Langho (NEAR BLACKBURN).—September 1st. Committee of Management. Cinematograph installation, electric lighting fittings and water turbine pump for Brockhall Institution. (August 12th.)

Litherland.—U.D.C. Electric light and power installations for the proposed new Council offices and Town Hall. A. J. Harrington, Clerk of the Council, Council Offices, Litherland, Liverpool (£2).

London.—COMMISSIONERS OF H.M. WORKS. August 24th. Electric bell material. (August 5th.)
September 2nd. Steel conduits and fittings for electric wiring. (See this issue.)
METROPOLITAN WATER BOARD.—September 21st. One high-compression heavy fuel-oil engine with electric generator and centrifugal pumps, one borehole pump, &c., at Wansunt pumping station. G. F. Stringer, Clerk of the Board, 173, Rosebery Avenue, E.C.1.
HAMMERSMITH.—August 29th. Electricity Department. Three-phase l.v. switchboard. (See this issue.)

Manchester.—September 7th. Electricity Department. One electrically propelled van. (See this issue.)

Midlothian.—August 23rd. County Council. Electrical work at thirty-six houses at East Calder. County architect, 10, Drumsheugh Gardens, Edinburgh, 3.

Newcastle-under-Lyme.—August 30th. Electricity Department. One transformer kiosk with e.h.v. and l.v. switchgear to house and control existing transformer. (See this issue.)

New Zealand.—WELLINGTON.—Public Works Department. September 6th. One three-phase, 300-kVA transformer. (T. 25017/38.)*
November 8th. 3,320 strings of e.h.v. transmission line suspension and strain insulators. (T. 25527/38.)*
October 11th. Three rotary d.c. welding plants. (T.25313/38.)*
September 20th. Two electrically driven air compressors. (T.Y. 25315/38.)*
November 1st. Remote control and metering equipment. (T. 24495/38.)* 50-kV outdoor steelwork and switchgear. (T.Y. 24300/38.)*
November 8th. 10,000-kVA transformer bank for section 4S8 of the Mangahao scheme. (T. 24496/38.)*
November 15th. Indoor switchgear and control equipment for Waitaki power station. (T. 24497/38.)*
January 17th. Power and control cables for extensions at the Waitaki power station. (T. 18568/38.)*
January 24th. 110-kV outdoor switchgear and steelwork. (T.Y. 250/38.)*
September 8th. Posts and Telegraph Department. 15,840 ft. of telephone cable. (T. 25010/38.)*
October 11th. 140 tons of cadmium copper wire. (T. 25553/38.)*
September 29th. Five motor-generator sets. (T. 18565/38.)*

Nottingham.—August 22nd. Rewiring at the County Hospital, Worksop. County architect, Shire Hall (deposit £1 1s.).

Penicuik.—September 3rd. Town Council. Electric lighting at thirty-two houses at John Street. Schedules from Morham & Brotchie, F.S.I., surveyors, 29, Hanover Street, Edinburgh; tenders to Town Clerk.

Plymouth.—September 3rd. Corporation. L.v. distribution boards and underground network disconnecting boxes. (August 12th.)

Saltcoats.—August 23rd. Town Council. Electric wiring in fifty-three houses. Schedules from Hugh Thomson & Sons, architects, 60, Hamilton Street (£1 1s.); tenders to Joint Town Clerk.

South Africa.—PORT ELIZABETH.—August 25th. City Electrical Engineer's Department. Two 3,000-kVA transformers. (T. 24373/38.)*
August 25th. Five 10,000-kVA reactors, 440-yd. of 6,600-V cable and one h.v., d.c. testing and fault localising equipment. (T. 24785/38.)*
JOHANNESBURG.—August 24th. City Council. One electro-dynamometer. (T. 24812/38.)*
September 14th. Fourteen metal clad l.v. a.c. switchboards. (T. 25412/38.)*
Public Works Department. August 25th. One 25 cu. ft. and five 6 cu. ft. electric refrigerators. (T. 25439/38.)*
PRETORIA.—September 1st. Union Tender and Supplies Board. Telephone apparatus. (T. 24816/38.)*
MOSSEL BAY.—September 24th. Municipality. Generating plant, transformer and cable. (T. 25577/38.)*

Stockton-on-Tees.—August 31st. Electricity Department. Meter-testing equipment. (August 5th.)

Stoke-on-Trent.—September 7th. Electrical Engineer's Department. Cookers, wash-boilers, kettles, storage water heaters and circulators. (August 12th.)
Electric cookers, water heaters, wash-boilers and irons for three years. (August 5th.)

Tobermory.—September 6th. Town Council. Electric lighting at housing estate. Town Clerk (deposit £1 1s.).

Uruguay.—MONTEVIDEO.—September 15th. Electricity Supply and Telephones Administration. 290 reflectors and lamps. (T.Y. 24680/38.)*

Uxbridge.—August 24th. U.D.C. Two electrically operated automatic booster pumps at the water tower, Uxbridge Common. Clerk of the Council, Council Offices.

Wakefield.—September 5th. Lighting installation at Thorne school. Education officer, County Hall.

Wath-upon-Dearne.—August 27th. Installation of wiring and fittings in eighty houses and bungalows.—W. E. Haigh, Town Hall.

Wembley.—Borough Council. August 26th. Street-lighting equipment. (August 5th.)

West Ham.—September 5th. Electricity Department. V.i.r. and tough rubber-sheathed wires and cables for one year. (August 12th.)

Weymouth.—August 31st. Dorset County Council. Electrical installations in new technical school. (August 12th.)

*Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Aberdeen.—Housing Committee. Accepted. Electrical work at Kaimhill housing scheme (£507).—R. Mair.

Cardiff.—Electricity Committee. Accepted. Battery for Docks sub-station (£270).—Britannia Batteries.
Libraries Committee. Accepted. Electrical alterations at central library (£58).—Page & Stibbs.

Douglas (I.O.M.).—Electricity Committee. Recommended. 3,300-V switchgear (£13,560).—A. Reyrolle & Co.

Durham.—County Council. Accepted for twelve months. Electric lamps.—Luxram Electric.

County Education Committee. Accepted. Electrical installation in school at New Silksworth (£238).—F. Reid, Ferens & Co.

Accepted. Electrical installation at instruction centre at Stockton (£139).—R. Robson.

Eston.—Highways Committee. Accepted. Traffic signals at Bennets Corner (£470).—Siemens & G.E.R. Signal Co.

Middlesbrough.—Town Council. Accepted. Cables.—Hackbridge Cable Co.; B.I. Cables; Enfield Cables.

Paignton.—Water Committee. Accepted. Electrical plant and wiring at filter house (£54).—E. M. Fawcett.

Plymouth.—Electricity Committee. Accepted. Internal telephone system (£401).—Lord & Shand.

Shipley.—Electricity Committee. Accepted. Two 750-kVA transformers (£1,204).—Hackbridge Electric Construction Co.

Sunderland.—Town Council. Accepted. Installation of electricity at the nurses' hostel at the Municipal Hospital (£1,725).—Beacon Elecl. Co.

Wakefield.—Housing Committee. Accepted. Wiring 230 houses on the Flanshaw estate (£1,571).—H. Goodyear.

Warwickshire.—Health Committee. Accepted. Installation of sound film apparatus at mental colony (£585).—B.T.H. Co.

Weymouth.—Electricity Committee. Accepted. Bovington-Moreton extension: Overhead and underground h.v. and l.v. cables, switchgear and transformers (£11,734).—Johnson & Phillips. Winterbourne Monkton extension: Overhead and underground h.v. and l.v. cables, switchgear and transformer (£1,601).—Johnson & Phillips. Lanehouse Road sub-station: H.v. switchgear (£599).—Crompton Parkinson. Transformer (£220).—Bonar Long & Co. L.v. switch (£24).—Electric Construction Co. Bowleaze Cove sub-station: H.v. switchgear (£460).—Crompton Parkinson. Transformer (£220).—Bonar Long & Co. L.v. switch (£24).—Electric Construction Co.

Personal and Social

Information regarding new appointments and other matters of interest for this page are welcomed

AT its last meeting the Hull Corporation confirmed the following promotions in the Electricity Department:—Mr. J. S. Dargavel from chief clerk to commercial assistant (N.J.B. Grade 3 £661); Mr. D. R. Friend from meter superintendent to sales superintendent (N.J.B. Grade 3 £661); Mr. H. W. Young from senior cost clerk to chief clerk (rising to £450 per annum); Mr. S. F. Musson from senior test assistant to meter superintendent (N.J.B. Grade 7 £448); and Mr. T. E. Evans from test assistant to senior test assistant (N.J.B. Grade 8a £378). These promotions take effect as from July 1st.

Mr. George N. Wright has been appointed chief electrical engineer to the London Power Co., Ltd., in succession to the late Mr. H. A. Ratcliff. Mr. Wright, who had for some years held the position of deputy to Mr. Ratcliff, was previously retained by the County of London Electric Supply Co., Ltd., in connection with the construction of the original Barking power station. Before coming to London he had been for twenty years a member of the technical staff of the Newcastle-upon-Tyne Electric Supply Co. and of Cleveland & Durham Electric Power, Ltd., now merged in the North-Eastern Electric Supply Co., Ltd. His first connection with the electricity supply industry was with the Nuneaton Corporation Electricity Department. Mr. Wright joined the Institution of Electrical Engineers as an Associate Member in 1912, and became a Member in 1921.

[Elliott & Fry
Mr. George N. Wright

Mr. W. Newman, of H. J. Baldwin & Co., Ltd., was married on August 12th to Miss N. Whitmore, of Manchester, and will in future be residing at Wilmslow, Cheshire.

Prof. Gillon, the director of the Institut Electromécanique de Louvain (Belgium), has recently been elected president of the Comité Electrotechnique Belge.

Mr. C. J. Hocking, mains engineer, has been appointed chief assistant in the Plymouth Corporation Electricity Department at a salary of £700 per annum.

Mr. F. W. Maynard, who has been for two years chief engineer with the East Hetton Colliery Co., has joined the mining department of A. Reyrolle & Co., Ltd., electrical engineers, Hebburn-on-Tyne. He has received a presentation from the colliery officials and workmen.

Mr. A. E. Somers has been elected a director of Britannia Electric Lamp Works (1934), Ltd., and appointed chairman in place of Mr. John Ismay, who has resigned.

Mrs. V. Z. de Ferranti, wife of the chairman of Ferranti, Ltd., distributed the prizes at the recent annual sports and gala of the company's employés at Hollinwood athletic ground. On the platform were Mr. V. Z. de Ferranti, who is president of the Recreation Club, Dr. J. Miller, Messrs. F. C. Aitken, A. Farmer, H. Hebbert, H. Taylor and F. Batt, who acted as judges.

Mr. R. E. Reynolds has been appointed area representative for the Eastern Counties for Ensign Lamps, Ltd. He is taking over the area from **Mr. T. Handley,** who was recently appointed assistant London manager.

Mr. E. C. Brooks, an installation engineer with Standard Telephones & Cables, Ltd.. New Southgate, is now in Colombo, Ceylon, supervising the installation of the island's automatic telephone service, which will be in operation by about June next year.

Mr. H. C. Duncan, commercial assistant to the electrical engineer, St. Helens Corporation, has retired after thirty-eight years' service. At a recent leave-taking ceremony, Mr. W. S. Johnston, electrical engineer, on behalf of the staff, presented him with a clock.

Mr. W. Powell, who has been in the service of Hastings Corporation for eighteen years, has sailed for South Africa, where he is taking up the appointment of superintendent of the Port Elizabeth power station. He began work at Hastings in a junior position at the power station and rose to be senior engineer in charge.

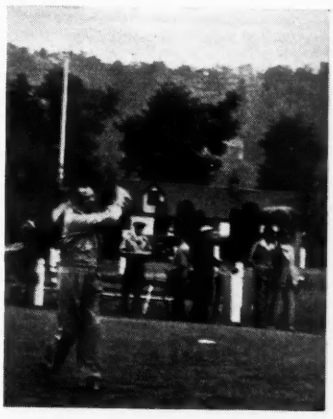
Mr. G. E. Power, consumers' engineer with the Derby Corporation Electricity Department, has been appointed honorary secretary of the Derby Branch of the Electrical Industries Benevolent Association in succession to **Miss D. H. Burrows,** whose wedding will take place on September 17th.

The Institute of Vitreous Enamellers, in collaboration with the British Cast Iron Research Association, has appointed **Dr. G. T. O. Martin** as Officer of Research to conduct investigations and experiments in connection with the application of vitreous enamel to cast and sheet iron. His activities will be controlled by a joint committee representative of both Institutes.

Mr. W. A. Gallon, chief assistant with Plymouth Corporation Electricity Department, has been appointed assistant borough electrical engineer at Southampton.

On behalf of the Plymouth and District Branch of the Electrical Association for Women, Councillor Mrs. C. H. Daymond, chairman of the Branch, recently presented **Mrs. W. A. Gallon** with a suitably inscribed silver cigarette case. Mrs. Gallon, who has been hon. secretary of the Branch for three years, is leaving Plymouth with her husband, whose new appointment is mentioned above. **Mrs. F. C. Isaac,** better known as Miss Edwards, late demonstrator with the Plymouth electricity undertaking and last year's winner of the Sloan Chesser Cup, is succeeding Mrs. Gallon.

On August 10th the Henley Golfing Society held a "Stapleford" competition at Sir Montague Hughman's club at Croham Hurst. The trophy, a silver-plated tankard, was won by Mr. V. B. Twiss, of Henley's contract department, with 38½ net points. Mr. W. C. Gibbs was runner-up with 29 points, and Mr. E. J. Vidler third with 28 points. While this competition was taking place the final match for the silver cup presented by Sir Montague Hughman was being played off by Mr. D. H. Melhuish and Mr. D. C. Mason. This was a very keen match and at the 18th hole the players were all square, Mr. Melhuish just managing to win at the 19th. Mr. Mason received a silver-plated tankard as a runner-up. After play had finished the members adjourned to the club dining room for dinner provided by Sir Montague Hughman. Mr. W. F. Bishop, director and general manager, and Sir Edward Crowe, one of Henley's directors, took part in the competition.



Mr. D. H. Melhuish driving from the first tee in the final match for the Sir Montague Hughman cup

Obituary

Mr. J. Barnard.—The death occurred on August 11th, at the age of sixty-four, of Mr. John Barnard, M.B.E., general manager of Bolton Corporation transport undertaking, who had spent part of the previous day in the annual inspection of the parks. It was intended to have the annual inspection of the Transport Department the following day, but this was abandoned. Mr. Barnard joined the Bolton Tramways Department over thirty-eight years ago. He built up a successful electric tramway system, and he still held the theory that the trams were more economical, and from a passenger-carrying standpoint, the best type of vehicle. He succeeded the late Mr. A. A. Day as tramways manager 25 years ago, and from the inception of the Lancashire & Cheshire Municipal Tramways Association in 1917 he was its secretary. He was also president of the old Municipal Tramways Association (now Municipal Tramways and Transport Association), and this year was appointed chairman of the National Joint Industrial Council for the road passenger transport industry, with which he had been associated nineteen years. In the New Year's honours of 1920 he was awarded the M.B.E., and in 1935 received the King's Silver Jubilee medal. During the war he was secretary to a Board of Trade Advisory Committee.

Mr. C. Kenyon.—News has been received of the death which occurred recently in Austria of Mr. Charles Kenyon, an electrical engineer engaged with the Central Electricity Board at Grid House, Manchester. He had recently passed his final examination with distinction. He was one of the occupants of a canoe which capsized on the River Inn.

Wills.—Mr. Samuel Whipp, founder and vice-chairman of Whipp & Bourne, left £71,775, with net personalty £68,069.

Mr. Samuel Insull.—The New York correspondent of *The Times* reports that Mr. Samuel Insull's will was filed at Chicago on August 11th and showed that he was worth $1,000 (£200) when he died in Paris on July 16th. In his aplication for letters testamentary Mr. Samuel Insull, jun., who is the executor, states that his father had turned over property worth $2,000,000 (£400,000) for the benefit of his creditors, whose claims amounted to $16,000,000 (£3,200,000). Insurances carried by the testator in the past had also been converted for the benefit of his creditors.

Mr. R. Blennerhasset, a director of a number of electricity supply companies, including Banbury and District, Kidderminster and District, Cornwall, Oxford, and Salisbury Electric Supply Companies, left estate in Great Britain of £67,255 (net personalty £65,119).

Electrical Development in France

AN interesting project which would provide an additional 112,000,000 kWh of electricity per year, and at the same time provide the city of Marseilles with an improved water system and protection from river floods, is attracting considerable attention, reports our Paris correspondent. So far, the project has gone no further than a suggestion, which, in principle, is that a new aqueduct, and a system to regulate the flood waters of the mountain streams which provide the flood threat on the lower Rhône river, should be built, each of these projects to be combined with a hydro-electric plant which would not only supply power but also help to make the other work economic. The present water supply system of Marseilles comes almost entirely from a single aqueduct. The second plant plant would be installed to utilise the waters from the mountain streams, permitting a regularisation of their flow. Such a system would mean that the power produced by the two new plants would have to be used in its entirety in order to render the scheme economic. Present feeds would, therefore, have in part to be relegated to the role of standby supplies. In this connection it is pointed out, however, that the various thermal uses of current have received practically no encouragement in Marseilles, electric cooking, for example, being practically unknown. The cheap power rates provided by the two new plants would permit special rates for the encouragement of electric cooking.

Mr. O. L. Frossard, Minister of Public Works, has explained the position and intentions of the Government in giving the recent subsidies to the electrical industry in France. Pointing out that consumption last year amounted to a total of about 18,000 million kWh, and is increasing at the rate of about 2,000 million kWh per year, he insisted on the urgent need for new plant. The present capacity is only about 20,000 million kWh, discounting old and uneconomic installations, so that future needs can only be supplied at the risk of increasing supply costs. This was the primary motive of the Government in providing subsidies for the industry. Commenting on the offer which had been made by the industry to provide extra capacity without Government help, he pointed out that the necessary extra plants seemed to the Government to be beyond the financial powers of the industry to provide. He stressed, furthermore, that the system of subsidies gives the Government a chance of introducing a system of minimum wages for the industry, which permits the solution of a social problem at the same time. Speaking of the future intentions, Mr. Frossard stressed the importance of drawing up a plan of electrical expansion. So far, plants have been built when and where they have been thought to be most convenient. The French network, however, has reached such a size now that more orderly planning of future expansion can alone guarantee economic development of power resources.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

C. E. Crookall, Ltd.—Private company. Registered August 11th. Capital, £500. Objects: To acquire the business of an electrical and radio engineer carried on by C. E. Crookall, at 29, Market Place, Poulton-le-Fylde, Lancs, as C. E. Crookall. The directors are: C. E. Crookall (permanent), and Mrs. J. H. Crookall, both of Thirlspot, The Avenue, Carleton, Blackpool, and Mrs. Ada Crookall, Miami, Maycroft Avenue, Carleton, Blackpool. Registered office: 12, Park Street, Lytham.

Tucker Electrical Co., Ltd.—Private company. Registered August 11th. Capital, £100. Objects: To carry on business as dealers in all kinds of electrical goods and accessories, wireless goods, &c. The subscribers are: Mrs. I. M. Tucker, and C. H. Tucker, both of 10, Burnaby Street, Cardiff. Registered office: 35, Windsor Place, Cardiff.

Whitehall (Civil) Contractors, Ltd.—Private company. Registered August 11th. Nominal capital, £100. Objects: To carry on the business of constructors, improvers, workers or developers of houses, estates, buildings and public works, tramways, docks, harbours, sewage, drainage, gas, electric light, telephone, telegraphic and power supply works, &c. The directors are: J. Wolstenholme, 55, Westbury Road, Finchley, N.12, and F. Knight, 143, Mayfair Avenue, Finchley, N.12, both directors of Whitehall Contractors, Ltd. Registered office: 11, Waterloo Place, S.W.1.

F. M. Charles and Co., Ltd.—Private company. Registered August 10th. Capital, £100. Objects. To carry on the business of manufacturers, assemblers, dealers, electrical and mechanical engineers, cabinet makers, wood and metal workers, &c. The directors are: A. E. Barker and C. M. de Wilde, both of 83, Pall Mall, S.W.1.

Berman's Transverse Drive, Ltd.—Private company. Registered August 8th. Capital, £500. Objects: To enter into an agreement with S. Berman to exploit and turn to account any processes and inventions, to carry on the business of advisers, electrical experts, consultants, engineers, technologists, &c. The subscribers are: Rose Roth, 4, Howard Walk, Finchley, N.2; and Yvette Beaumont, 12, Swanage Road, S.W.12. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

Eastick, Ltd.—Private company. Registered August 8th. Capital, £500. Objects: To carry on the business of manufacturers of and/or dealers in mechanical, electrical, chemical and photographic goods and appliances, wireless and other sound and vision-producing or reproducing instruments, &c. The subscribers are: H. S. Boucher, Park West, Edgware Road, W.; and L. C. Maddison, 21, Leinster Square, W.2. Solicitors: Godfrey Warr & Co., 19, Fenchurch Street, E.C.3.

Electric Rentals, Ltd.—Private company. Registered August 10th. Capital, £1,000. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in radio and television equipment, vacuum cleaners, electric irons, radiators, hair dryers, washing machines and appliances, &c. The subscribers are: Clara Hillman, 32, Queen Anne's Gardens, Bush Hill Park, Enfield, Middlesex; and Bettie Montague, 7, Gumleigh Road, Ealing, W.5. Registered office: Donington House, Norfolk Street, Strand, W.C.2.

Luminex, Ltd.—Private company. Registered August 12th. Capital, £5,000. Objects: To carry on the business of manufacturers of and dealers in neon and other signs, electric incandescent lamps, electrical accessories, &c. The subscribers are: H. L. Roditi, 56, Curzon Street, W.1, and E. Ainger, 106, Ebury Street, S.W.1. Registered office: 4, Langham Street, Portland Place, W.1.

Laystall Engineering Co., Ltd.—Private company. Registered August 11th. Nominal capital, £100. Objects: To acquire the business, undertaking and assets of the Laystall Motor Engineering Works, Ltd. (which is in course of changing its name to L.M.E.W., Ltd.), including all patents, rights, trade names, trade marks, secret processes and inventions used in connection therewith; and to carry on the business of die-casters, makers and sinkers, manufacturers of, dealers in and agents for pistons, piston rings, valves, valve seats, cylinder liners, castings and forgings, engineers, garage proprietors, electrical, wireless, oil fuel, mechanical, internal combustion.

marine and aeronautical engineers, &c. The subscribers are: F. H. Morley, Patmore Hall, Albury, Herts; and A. T. Pelling, 107, Vale Crescent, Kingston Vale. Joshua Bigwood & Son, Ltd., have the right to nominate two directors while holding 20,000 ordinary shares. A director need not be a shareholder. The directors' borrowing powers are restricted to an amount not exceeding the company's nominal capital. The registered office is at Laystall House, Ewer Street, Southwark, S.E.1.

Goodmayes Stores, Ltd.—Private company. Registered August 13th. Capital, £400. Objects: To carry on business as manufacturers, importers, exporters, hirers and repairers of and dealers in bicycles, perambulators, tricycles, motor cars and cycles, electrical and mechanical apparatus, wireless sets, &c. The directors are: S. F. Whitlock, 10, Hillcrest Road, South Woodford, Essex, and G. D. Tomlin, 825, High Road, Goodmayes. Registered office: 825, High Rd., Goodmayes, Essex.

Returns of Electrical Companies

Precision Moulders, Ltd.—Two debentures charged on the company's undertaking and property, present and future, including uncalled capital, both dated August 4th, 1938, to secure £700 and £300 respectively. Holder: Albert Freedman, 21, Farhazel Gardens, West Hampstead, N.W.6.

South Metropolitan Electric Light & Power Co., Ltd.—Particulars have been filed of debenture stock for £1,500,000 (inclusive of £1,000,000 already registered), authorised by resolutions of May 29th, 1931, July 14th, 1936, and July 22nd, 1938, and secured by trust deeds dated July 1st, 1931, July 17th, 1936, and July 27th, 1938. The stock constitutes a charge on the company's undertaking and property, present and future, including uncalled capital. The amount of the present issue is £500,000. Trustees: Frank C. Tiarks and Geo. V. Tate.

Eureka Vacuum Cleaner Co., Ltd.—Satisfaction to the extent of £1,315 15s. 8d. on June 30th, 1938, of debenture dated July 8th, 1937, and registered July 15th, 1937.

Corlett Electrical Engineering Co. (1933), Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital dated July 27th, 1938, to secure all moneys due or to become due from the company to Union Bank of Manchester, Ltd.

The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £1,500.

Polperro Electric & Cold Storage Co., Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th (filed May 5th), 1938. 9,373 shares taken up. £8,373 paid. £1,000 considered as paid. Mortgages and charges, nil.

Orion Lamps, Ltd.—Capital, £2,000 in £1 shares. Return dated November 13th, 1937 (filed May 19th, 1938). 1,245 shares taken up. £1,245 paid. Mortgages and charges, nil.

Thomasson & Co. (Shrewsbury), Ltd.—Capital, £1,000 in £1 shares. Return dated March 11th, 1938. 767 shares taken up. £767 paid. Mortgages and charges, nil.

Hedin, Ltd.—Capital, £2,000 in £1 shares. Return dated December 2nd, 1937 (filed May 10th, 1938). Two shares taken up. £2 paid. Mortgages and charges, nil.

H.S. Electrical Services, Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £2,000.

Isle of Thanet Electric Supply Co., Ltd.—Capital, £500,000 in 150,000 ordinary, 282,000 6 per cent. cumulative participating preference, and 68,000 unclassified shares of £1. Return dated April 13th, 1933. 150,000 ordinary and 282,000 preference shares taken up. £222,000 paid on 222,000 preference shares. £210,000 considered as paid on 150,000 ordinary and 60,000 preference. Mortgages and charges: £245,274.

Ozonair, Ltd.—Capital, £40,000 in 77,600 preference and 322,400 ordinary shares of 2s. Return dated April 25th, 1938. 77,600 preference and 30,520 ordinary shares taken up. £4,252 paid on 42,520 ordinary shares. £11,560 considered as paid on 38,000 ordinary and 77,600 preference shares. Mortgages and charges, nil.

Machynlleth Electric Supply Co., Ltd.—Capital, £7,000 in £5 shares. Return dated April 26th, 1938. All shares taken up. £7,000 paid. Mortgages and charges, £2,479 2s. 3d.

Cambridge Electric Supply Co., Ltd.—Capital, £600,000 in £1 shares. Return dated May 4th, 1938. 500,000 shares taken up. £500,000 paid. Mortgages and charges, £30,000.

V. C. Bond, Ltd.—Capital, £5,000 in £1 shares. Return dated May 19th, 1938. 4,002 shares taken up. £4,002 considered as

Electrical Trading Association, Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th. 2,502 shares taken up. £2,502 paid. Mortgages and charges, £18,000. A return of allotments, made up to January 26th, 1938, shows a further 4,500 shares allotted for cash and fully called up.

Goldhawk Electric Co., Ltd.—A. E. Dunnill, 113, Kingsway, W.C.2, ceased to act as receiver and manager on August 4th. C. G. Peel, of 113, Kingsway, W.C.2, was appointed receiver and manager on August 5th under powers contained in debenture dated June 4th, 1937.

Bullers, Ltd. (62,020), 6, Laurence Pountney Hill, E.C.4.—Satisfaction in full on August 27th, 1920, of memorandum of deposit of deeds dated September 27th, 1916, and registered October 31, 1916. (Notice filed August 8th, 1938.)

Instanta Electric, Ltd.—Particulars filed of debentures not exceeding £1,000, authorised July 29th, 1938, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £500.

City Notes

Edmundsons Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during July, as compared with the corresponding month of 1937, show an increase of 8 per cent. in kWh sold.

John Ismay & Sons, Ltd.—Presiding at the annual meeting held on August 11th Mr. J. Ismay (chairman and managing director) said that the small decrease in the net profit for the year under review was caused through the cost of raw materials and production generally having gone up, and the fact that they had been able to reduce the prices of their finished lamps without in any way sacrificing their quality. Actually the year's turnover had shown an increase on the previous year. The sales of lamps had continued to expand both at home and abroad—their export trade had nearly doubled and they had supplied more dominion municipalities and supply companies. In the home trade they had also increased the number of supply company customers. They had finished their extension plans and were now consolidating their business. During the year they spent a considerable amount of money on development from which they hoped to get the benefit in the future.

The Telephone Co. of Pernambuco, Ltd., reports a revenue for 1937 of 1,109 contos, after allowing for all operating expenses, including taxes, but before providing for fixed charges and depreciation. This compares with net revenues similarly calculated of 870 contos for 1936. After meeting fixed charges and making allowances for depreciation, the sterling revenue account shows a balance of income (before exchange adjustment) of £1,833, which is carried forward in reduction of the deficit, as compared with a net loss of £1,582 for 1936. The deficit at December 31st stood at £20,172. Operating revenues improved by 149 contos during the year, while operating expenses decreased by 90 contos. The improvement in operating revenues resulted principally from the connection of 412 additional telephone subscribers, which was made possible by the installation in 1937 of additional automatic switching equipment and increased cable capacity.

The Tata Power Co. proposes to repay all the 7½ per cent. "B" mortgage debenture stock now outstanding on November 1st at par. The company states that the instalment of the sinking fund for the current year is in excess of the total amount required to effect the proposal.

Waite & Son, Ltd., report a net profit for the year ended March 31st, before tax, of £5,299, to which is added £1,005 brought forward. After placing £1,241 to tax reserve and £1,000 to general reserve it is proposed to pay a dividend of 6 per cent., less tax (against 6 per cent., tax free), and to carry forward £1,019.

The Folkestone Electricity Supply Co., Ltd., has announced an interim dividend of 4 per cent., tax free (same).

The South Metropolitan Electric Light & Power Co., Ltd., is maintaining its interim dividend at 3 per cent., less tax.

The Compania de Electricidad de la Provincia de Buenos Aires is paying a first and final dividend of 8 per cent. on the 8 per cent. non-cumulative pre-preference shares and 6 per cent. on the 8 per cent. non-cumulative participating preference shares (unchanged).

Strand Electric Holdings, Ltd., has declared a final dividend of 6 per cent., making 10 per cent. for the year (same).

The Clyde Valley Electrical Power Co. is maintaining its ordinary interim dividend at 3 per cent., less tax. No payment on the £1,050,000 of new ordinary shares allotted in June last is to be made at this time, but in the terms of the offer these will be dealt with in the final distribution for the year.

Waygood-Otis, Ltd., has announced an interim dividend of 12½ per cent., less tax (same).

Brilliant Signs, Ltd., is paying the half-yearly dividend of 3 per cent. on the cumulative preference shares of 10s. each.

The Rangoon Electric Tramway & Supply Co., Ltd., has announced an interim dividend of 6 annas per share, free of Burman tax (same).

Stocks and Shares

TUESDAY EVENING.

THE course of Stock Exchange markets is determined, for the time being, by European politics, American conditions and holiday influences, none of which can be said to exercise a bullish effect upon prices. The markets as a whole are so quiet that a very little selling, or a very little buying, suffices to bring about fluctuations disproportionate to the volume of actual trade.

The uncertainties surrounding European politics are responsible for an incessant demand for gold, the metal, the price of which has been going up steadily almost every day. The buyers are large capitalists who are investing their funds in the metal rather than into Stock Exchange securities. The small man has little chance of taking any hand in the purchase of gold. He has to be content with buying gold-mining shares. But the very considerable sums now being spent in the purchase of the metal are diverted from what normally would be investment in gilt-edged securities, and the prices of the latter show an inclination to dullness.

The industrial markets are over-shadowed by a vague apprehension of the course of domestic trade, as this is reflected in the continued falling away of home railway receipts and the discouraging Board of Trade returns. American conditions affect our market to a smaller extent, the pause which has occurred in the upward movement of American stocks and shares serving as an indirect factor in restraint of enterprise over here.

Electrical Equipment and Manufacturing

Interest remains very much alive in the negotiations between Callender's and Crompton Parkinson, but there is evidently no inclination to resume active dealings in the shares until more is known of the basis on which the two companies will be linked up. Rumour is airily coupling a third company to the team, without receiving much attention. Enfield Cables shares have stolen most of the thunder in the electrical equipment market, the price having risen 3s. 9d. to 53s. 9d. In connection with the recent interim dividend announcement it was recalled here last week that the payment of 6¼ per cent. was

exactly equivalent to last year's 10 per cent., making allowance for a scaling down in proportion to the 60 per cent. increase in capital last March. Assuming that the second payment will be in similar proportion to last year's final, the full year's distribution will be approximately 15½ per cent., giving a yield of close on 6 per cent. on the present price of the shares. The recent buying is said to have been on behalf of people working on that assumption, and believing the indicated yield to be generous from a share of high reputation. Ever Ready shares, at 18s. 6d., and Reyrolle's, at 60s. 6d., are weak spots in a generally steady market. The 5s. shares of Strand Electric Holdings, which announces a final dividend again making 10 per cent. for the year, are quoted at their par value.

Preference Share Comparisons

Repayment at par is a possibility of which preference shareholders as a class are occasionally reminded. In the great majority of cases the chance is so remote as to be virtually negligible; but its existence is recognised clearly enough in the price lists of industrial preference shares. In the case of electricity supply companies' issues, discrimination is obvious. For, although seemingly secure on the shelf for the time being, the Electricity Bill foreshadows amalgamations which may result in repayments of capital. Consequently, the popular choice is for shares standing within easy reach of par rather than for higher-priced issues which carry just an element of doubt as to their position in the event of liquidation. The higher the price, the higher the yield is a dictum applicable, at present, to this field of investment.

Prices and Yields

One or two examples of this predilection for low-priced preference shares stand out prominently at the moment. County of London Electric 4 per cent. and 6 per cent. preference shares are of equal standing in all respects, except that the 6 per cents. have a slight pull in the event of a repayment of capital. Yet the yield of £3 18s. 8d. per cent. on the sixes, which stand at 30s. 6d., is fully 5s. per cent. higher than the return on the fours. These can be bought at only 1s. 9d. over the par value. It is the same with Scottish Power preference shares, of which the 6 per cents., at 29s. 9d., pay over 4 per cent., and the 4 per cents., at 21s. 3d., yield only 3¾ per cent. Between the yields on Midland Counties 6 per cent. preference, at 30s. 3d., and the 4½ per cents. at 23s., there is a difference in yield of more than 5s. per cent. in favour of the lower-priced shares. As is the case with the County of London issues, the only difference in the status of the shares of the two last-mentioned companies favours the 6 per cent. issues in the event of a winding-up.

American Communications

Stocks of the United States companies, American Telephone and Telegraph, Western Union and Radio Corporation, are among the dollar issues which find a place in the London Stock Exchange official or unofficial lists of quotations. The three companies have issued, within the last few days, half-yearly reports which bear somewhat heavy marks of the business depression. In a comparison with last year's relative figures, American "Tel. & Tel." emerges fairly satisfactorily with a drop in net income from 87.3 to 75.7 million dollars. Western Union, however, has a net loss of one and a half million dollars, to go against a profit of over two millions; while Radio Corporation net profits are more than two million dollars down, at two and a half millions. Drastic as these reverses may appear to eyes accustomed to British utility companies' results, they are almost modest compared with the figures which some of the American industrial concerns are reporting. Wall Street continues to show signs of giddiness after the breathless ascent, and prices have been marked down to levels which represent a less carefree interpretation of the business position. On the week the price of American "Tel. and Tel." is unchanged at 144½, which compares with this year's low point of 111. Western Unions are 2 points down at 29½. The stock has changed hands lately down to 16¼.

Miscellaneous Matters

Home railway stocks had a brief rally before another depressing set of traffics figures—covering the Bank-holiday week—again put prices lower. London Transport "C" stock, at 73½, has turned a shade easier: the Board's annual report will be due very shortly. Tillings, at 44s. 6d., have dropped 1s. since the 5 per cent. interim dividend payment. This is at the same rate as last year's, but payable on capital since increased by the 10 per cent. capital bonus. The gilt-edged market is having a holiday from fresh Corporation borrowing, and prices show little movement. Similar conditions prevail among electricity supply shares. Output of electricity in July is announced by the Commissioners to have been 4.3 per cent. greater than last year's corresponding amount. In the telegraph and telephone group, Cable and Wireless ordinary, at 52, and the preference at 97, are each a point lower. Great Northerns are 10s. up at 38½. British Sangamo 10s. shares stand at 31s. 3d., to yield a little more than 4¾ per cent. on the 15 per cent. dividend which has been paid in each of the two years since the company was made public. The company announces a decision to acquire the whole issued capital of Weston Electrical Instruments. Profits have been distributed to date with noteworthy conservatism, the dividends being covered by earnings more than three times greater than the amount paid out.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Last.	Price Aug. 16.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	66/3	—	4 10 7
City of London	1	7⅛	7⅛	33/6	—	4 9 7
Clyde Valley	1	7	8	38/–	—	4 4 3
County of London	1	10½	10½	49/6	—	4 4 7
Edmundson's 7% Pref.	1	7	7	32/6	—	4 7 6
Do. Ord.	1	8	9	27/6	—	—
Elec. Dis. Yorkshire	1	9	9	42/6	—	4 4 9
Elec. Fin. and Securities	1	12½	12½	50/–	—	5 0 0
Elec. Supply Corporation	1	11	12	53/9	—	4 9 5
Lancs Light and Power	1	7⅛	7⅛	32/–	—	4 13 9
Lond. Assoc. Electric	1	—	7	30/–	—	4 13 4
London Electric	1	8	7	35/6	—	3 19 0
London Power Deb. Red.	Stock	5	5	105½	−1	4 14 9
Metropolitan	1	10	12	50/–	—	4 16 0
Midland Counties	1	7½	8	38/–	—	4 4 3
Mid. Elec. Power	1	8	9	40/9	—	4 8 3
North Eastern Electric Ordinary	1	7	7	33/–	—	4 4 10
Do. 7% Pref.	1	7	7	33/–	—	4 3 10
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	48/9	—	4 2 0
Do. do. 6% Pref.	1	6	6	29/6	—	4 1 4
Scottish Power	1	8	8	38/–	—	4 4 3
South London	1	7	7	32/–	—	4 7 6
Victoria Falls Ord.	1	12	13½	75/–	—	3 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	—	8 0 0
Yorkshire Elec.	1	8	8	41/–	—	3 18 1
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	„	5	5	116½	—	4 5 10
Do. 1951–73	„	4½	4½	109	—	4 2 7
Do. 1963–93	„	—	3½	101	+½	3 9 4
London Elec. Trans. Gtd.	„	—	2½	92	—	2 14 4
London & Home Counties, 1955–75	„	4½	4½	112½	—	4 0 0
London Passenger Transport, A	„	—	4½	118½	—	3 16 9
Do. do. B	„	—	5	119½	—	4 3 8
Do. do. C	„	4	4½	73½	−½	5 15 8
West Midlands Joint Elec. 1948–68	„	—	5	113	+1	4 8 6
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	144½	—	6 4 7
Anglo-Am. Tel. Pref.	Stock	6	6	110	+1	5 10 1
Do. Def.	„	1½	1½	26	—	5 15 5
Cable & Wireless 5½% Pref.	„	4½	5½	97	−1	5 13 5
Do. Ord.	„	—	4	52	−1	7 13 10
Do. Income	„	—	—	102	—	3 18 2
Globe Tel. & Tel. Ord.	1	5½*	7½*	32/–	—	4 13 9
Do. do. Pref.	1	6	6	27/–	—	4 9 0
Great Northern Tel.	10	20	20	38½	+½	5 4 0
Marconi-Marine	1	10	7½	27/6	—	5 9 1
Oriental Telephone Ord.	1	12*	12*	58/9	—	4 1 8
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	5/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	5/–	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	12	—1	—
British Electric Traction Def. Ord.	„	5	5	950	—50	—
Do. do. Pref. Ord.	„	8	8	170	—	4 14 2
Brazil Traction	$100	70 cts.	$1	12	−1	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	100	—	5 0 0
Mexican Light Common	$100	Nil	Nil	1	—	—
Do. do. 1st Bonds	$500	5	5	26½	—	—
West Riding	1	6½	10	35/–	—	—
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	1⅝	—	9 4 8
Assoc. Elec. Ord.	1	10	10	38/6	−6d.	5 4 0
Do. Pref.	1	8	8	37/–	+6d.	4 6 6
Babcock & Wilcox	1	10	10	37/6	−⅛	5 6 8
British Aluminium Ord.	1	10	12½	49/6	—	5 1 0
British Insulated Ord.	1	20	20	4⅝	—	4 6 6
Brush Ord.	5/–	Nil	Nil	5/3	—	—
Callenders'	1	20	20	5	—	4 0 0
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/–	12½	12½	27/6	—	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	10	12½	33/9	—	7 8 0
Enfield Cable Ord.	1	25	25	2⅛	+3/9	—
English Electric	1	Nil	10	30/6	—6d.	6 11 0
Do. do. Pref.	1	6½	6½	26/–	—	5 0 0
Ericsson Tel.	5/–	25	25	2	+⅛	3 2 6
Ever Ready	5/–	45	35	18/6	−1/6	9 9 2
Ferranti Pref.	1	7	7	27/6	—	5 2 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	17½	20	77/–	−6d.	5 4 0
Henley's	5/–	15	20	21/3	—	4 14 1
Do. 4½% Pref.	1	4½	4½	21/3	—	4 4 8
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	10	12½	38/9	—	6 8 10
Lancashire Dynamo	1	20	25	3	—	8 6 8
Siemens Ord.	1	7½	7½	25/–	—	6 0 0
Telegraph Construction	£1	7½	10	2½	—	4 14 0

* Dividends are paid free of Income Tax.

New Patents

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 23, Southampton Buildings, London, W.C.2.

17251. "Servomotor systems for effecting position control." R. H. Nisbet and Sperry Gyroscope Co., Ltd. October 22nd, 1936. (489271.)

28373. "Superheterodyne wireless receivers." Marconi's Wireless Telegraph Co., Ltd. October 17th, 1935. (489094.)

28729. "Circuits for television receivers." Telefunken Ges. für Drahtlose Telegraphie. November 2nd, 1935. (489275.)

31247. "Regulating transformer." M. Rosenfeld. April 28th, 1936. (489095.)

31308. "Cathode-ray tubes." Radioakt. Ges. D. S. Loewe. November 16th, 1935. (489028.)

31490. "Anodic treatment of aluminium and aluminium alloys." C. H. R. Gower and E. Windsor-Bowen. November 17th, 1936. (489220.)

34237. "Direction-finding, particularly for aircraft." Sperry Gyroscope Co., Inc. December 13th, 1935. (489032.)

34725. "Means for controlling and protecting electric circuits." British Thomson-Houston Co., Ltd. December 17th, 1935. (489037.)

35103. "Apparatus for sound recording." Klangfilm Ges. December 21st, 1935. (489223.)

1937

1331. "Electric water heaters." Santon, Ltd., and H. C. Sanders. January 16th, 1937. (489224.)

1593. "Television or like systems." Baird Television, Ltd., and P. W. Willans. January 19th, 1937. (489102.)

1629. "Telephone systems." Automatic Telephone and Electric Co., Ltd., and O. A. Pearce. January 19th, 1937. (489107.)

1713. "Coin-actuated mechanism for electricity and similar meters." United Gas Industries, Ltd., and H. E. Angold. January 20th, 1937. (Addition to 458072.) (489040.)

1727. "Aerial systems for wireless reception and transmission." Gramophone Co., Ltd., and L. A. Chapman. January 20th, 1937. (Addition to 444494.) (489174.)

1728. "Television systems." Electric and Musical Industries, Ltd., and C. L. Faudell. January 20th, 1937. (Addition to 455375.) (Cognate application 7971/37.) (489231.)

1927. "Mosaic electrodes for electron-discharge devices." Baird Television, Ltd., V. A. Jones and T. C. Nuttall. January 22nd, 1937. (489282.)

1934. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. January 24th, 1936. (489283.)

1945. "Sealing of electric conductors into metal tubes." Arcturus Radio Tube Co. January 24th, 1936. (489287.)

1953. "Rotating plate condenser." Radioakt. D. S. Loewe. January 25th, 1936. (489113.)

1957. "Thermionic amplifiers." Standard Telephones and Cables, Ltd., and C. E. Strong. January 22nd, 1937. (489289.)

1958. "X-ray tubes." Standard Telephones and Cables, Ltd., and R. A. L. Cole. January 22nd, 1937. (489290.)

1959. "Driving means for electric condensers." Standard Telephones and Cables, Ltd., and I. Feldhusen. January 22nd, 1937. (489291.)

1985. "Liquid-break electric circuit-breakers." C. H. Flurscheim and Metropolitan-Vickers Electrical Co., Ltd. January 22nd, 1937. (Cognate application 1986/37.) (489336.)

2005. "Systems for supplying modulated electric currents to electromagnetic devices." Western Electric Co., Ltd. (Electrical Research Products, Inc.). January 22nd, 1937. (Cognate application 24102/37.) (489178.)

2013. "Electrodeposition of cadmium." E. I. Du Pont de Nemours and Co., and J. A. Henricks, Jun. January 22nd, 1937. (489339.)

2051. "Electric cables." Callender's Cable and Construction Co., Ltd., L. G. Brazier and G. M. Hamilton. January 23rd, 1937. (489301.)

2086. "Manufacture of electrical accessories having relatively light contact leaves embedded in an insulating mass, such as electric lamp caps." A. Friedl. January 23rd, 1937. (489303.)

2172. "Electric discharge lamps." British Thomson-Houston Co., Ltd. January 25th, 1936. (489238.)

2179. "Producing artificial echo." General Electric Co., Ltd., and K. A. Macfadyen. January 25th, 1937. (489179.)

2180. "Electric battery charging systems." General Electric Co., Ltd., and E. H. Croft. January 25th, 1937. (489239.)

2191. "Television and like systems." Telefunken Ges. für Drahtlose Telegraphie. January 24th, 1936. (489307.)

2207. "Thermionic valves." Standard Telephones and Cables, Ltd., W. T. Gibson and W. R. Moscrip. January 25th, 1937. (489309.)

2550. "Electric battery lamps." Ever Ready Co. (Great Britain), Ltd., and M. C. Terry. January 28th, 1937. (489182.)

2701. "Loud-speaking telephone systems." Telephone Manufacturing Co., Ltd., and J. G. Flint. January 29th, 1937. (489115.)

3488. "Systems of illumination." Claude-General Neon Lights, Ltd., T. L. Collins and C. Higgins. February 5th, 1937. (489186.)

3842. "Connecting devices for luminous electric discharge tubes." Claude-General Neon Lights, Ltd., and C. Higgins. February 9th, 1937. (489241.)

4581. "Combined electromagnetic and thermal relay arrangements." General Electric Co., Ltd., J. E. Collyer and N. C. Smart. February 16th, 1937. (489118.)

4735. "Electric vacuum cleaners." Naamlooze Vennootschap Radiofabriek and Ingenieursbureau Voorheen van der Heem and Bloemsma. February 21st, 1936. (489242.)

5182. "Tuning coils for use in radio receiving sets or the like." E. K. Cole, Ltd. (Rowe Radio Research Laboratory Co.). February 22nd, 1937. (489048.)

5789. "Controlling mechanisms for electric motors." J. G. Smithson and Co. and J. G. Smithson. February 26th, 1937. (489119.)

8531. "Metal-vapour discharge lamps." Siemens Electric Lamps & Supplies, Ltd., J. N. Aldington and A. J. Meadowcroft. March 23rd, 1937. (489051.)

8569. "Electric condensers." Steatit-Magnesia Akt. Ges. March 23rd, 1936. (Addition to 467443.) (489052.)

10103. "Electric tumbler switches." R. G. Avison and J. H. Tucker & Co., Ltd. April 9th, 1937. (489196.)

10135. "Electric transformers." E. H. Roberts. April 9th, 1937. (489054.)

10548. "Wall-boxes for switches and other electrical units." C. L. Arnold, R. W. Dowsett and M. K. Electric, Ltd. April 13th, 1937. (489056.)

13359. "Image dissectors for use in television transmitting systems." P. T. Farnsworth. May 11th, 1937. (489199.)

14525. "Secondary emission electron multipliers." General Electric Co., Ltd., and C. H. Sims. May 25th, 1937. (489130.)

16333. "Electrical systems of remote control." General Electric Co., Ltd., J. E. Collyer and N. C. Smart. June 12th, 1937. (489134.)

17875. "Small synchronous electric motors." Chamberlain & Hookham, Ltd., S. James and R. P. Bossom. June 26th, 1937. (489246.)

20349. "Train describer systems for railways." General Railway Signal Co. July 23rd, 1936. (489138.)

20757. "Signalling arrangements in telephone and the like systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc. July 27th, 1937. (489204.)

21184. "Telephone and telegraph exchange systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). July 30th, 1937. (489070.)

21204. "Electric control and/or indicating systems." General Railway Signal Co. August 1st, 1936. (489206.)

22090. "Electric furnace for the melting of glass." Soc. Anon. des Manufacturers des Glaces et Produits Chimiques de St. Gobain Chauny et Cirey. August 14th, 1936. (489207.)

24152. "Motor generators of the vibrating armature type for the interconversion of alternating-currents and mechanical vibrations." Standard Telephones & Cables, Ltd. September 16th, 1936. (489075.)

27796. "Electromagnetically operated direction-indicators." R. Bosch Akt. Ges. October 16th, 1936. (489253.)

28734. "Electric lamps." Birdseye Electric Corpn. November 2nd, 1936. (489255.)

28894. "Automatic selectivity control for radio receivers." British Thomson-Houston Co., Ltd. October 22nd, 1936. (489256.)

30235. "Permanent magnet unit comprising material of high coercive force." Landis & Gyr Akt. Ges. November 23rd, 1936. (489258.)

32504. "Thermionic valve arrangements for producing short signal impulses." International Business Machines Corpn. December 1st, 1936. (489325.)

32948. "Magnetic recording and reproducing of sound." Allgemeine Elektricitäts Ges. November 28th, 1936. (489261.)

1938

6834. "Electric transformers." British Thomson-Houston Co., Ltd. March 5th, 1937. (489158.)

9892. "Photo-electric screens for television and methods of manufacturing the same." C. Lorenz Akt. Ges. March 31st. 1937. (489270.)

11196. "Distributing or separating boxes for electric cables." F. H. Wheeler. April 12th, 1938. (Addition to 399902.) (489159.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 10th :—

Petovac. No. 586597. All goods in Class 6.—Peto Scott Electrical Instruments (Holdings), Ltd., Pilot House, Stoke Newington Church Street, N.16.

Neron-Ultra-Vitalux. No. 586568. Class 13. Electric lamps (ordinary).—Osram Gesellschaft, Berlin. (British representatives: Cruikshank and Fairweather, 65-66, Chancery Lane, W.C.2.)

Lectochime. No. 583810. Class 18. Electric alarms as systems in buildings.—Sydney S. Bird & Sons, Ltd., Cyldon Works, Cambridge Arterial Road, Enfield, Middlesex.

Rhodolene. No. 585001. Class 50. Thermosetting and thermoplastic mouldable compositions, also synthetic resins, sold in the form of rods, blocks, tubes, powders, grains or shaped pieces.—La Societé des Usines Chimiques Rhone-Poulenc, Paris. (British representatives: Mewburn, Ellis & Co., 70-72, Chancery Lane, W.C.2.)

A New Encyclopedia

"Scientific Encyclopedia" (D. Van Nostrand Co., U.S.A.). (Pp. 1,234, illus.) London: Chapman & Hall, Ltd. Price 50s. This work contains more than ten thousand terms used in the basic and applied sciences, and the three main branches of engineering. The arrangement is alphabetical, cross-indexed extensively, with the significant words in bold-face type, which makes it easy to turn readily to every entry that has a supplementary bearing on the particular subject. A feature of this volume is the progressive development of the discussion of each topic, beginning with a plain definition and progressing to reflection of the more detailed aspects, with indications of changes that are taking place in concepts.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Amersham.—Houses (42); R.D.C. surveyor.

Andover (HAMPSHIRE).—Police station (£14,650); county architect.

Arnold.—Houses (42), near Churchmoor Lane; J. Higginbottom, architect, 76, Friar Lane, Nottingham.

Barking.—Premises, Gale Street, for Grays Co-operative Society, Ltd.

Bedfordshire.—Gymnasium and domesic science block, Cedars school, Leighton Buzzard (£7,443), for County Council.

Bexhill-on-Sea.—Development of Church Farm estate; Wrestwood Estates, Ltd.

Birmingham.—Houses (66), Chaffcombe Road, Stechford; Davis Estates, Ltd., Sheldon. Block of offices for the Colonial Mutual Life Assurance, Great Charles Street; Percy Cox, Ltd., builders, Grove Lane. Municipal Bank, Newtown Row, Aston; T. Elvins & Son, builders, Soho Hill.

Bognor Regis.—Fire station; U.D.C. surveyor.

Bootle.—Estate development, Carisbroke Road; Greyland Estates, Ltd. Library and hall, Orrell; borough engineer.

Bournemouth.—Bathing station, West Beach (£13,246); W. Hayward & Sons, Ltd. Development of Muscliff Farm estate; South Coast Land Society, Ltd. Hospital, Linford (£80,000); borough engineer. School, Boscombe (£30,606); J. A. Perriss.

Bradford.—Houses and bungalows, near Canterbury Avenue, for T.C.; Henry Boot & Sons, Ltd., builders, Banner Cross Hall, Sheffield.

Bristol.—Large flour mills, &c., Avonmouth Docks (£150,000); for C.W.S.; L. G. Ekins, architect, 99, Leman Street, London, E.1.

Bromsgrove.—Houses (810), Copton Common estate; S. J. Smith & Co.

Broom.—School (£78,150); G. W. Lazenby & Co., Ltd., Ferryhill.

Cardiff.—Cinema, Rumney, for The Splott (Cardiff) Cinema Co., Ltd.; W. S. Wort, architect, 15, Windsor Place, Cardiff.

Caterham.—Flats (48), Stafford Street; U.D.C. surveyor.

Charlton Kings.—Houses (18), Priors Road; D. J. H. Flooks.

Chelmsford.—Houses (18), Chalmer Road; A. Ash. Block of offices, New Street; Marconi, Ltd.

Cheltenham.—Houses (42), Leckhampton Farm; D. Hicks. Flats (24), Elmfield Park estate; Cunningham & Giband. School, Whaddon estate, for the E.C.

Cirencester.—Houses (129), Chesterton estate; U.D.C. surveyor.

Colchester.—Additional accommodation at Isolation Hospital (£16,578); borough surveyor.

Cradley Heath.—Extensions to works, for The Cradley Boiler Co., Ltd.

Crook (Co. DURHAM).—Factory, Low Beechburn Colliery site; Crook Briquette Co., Ltd.

Devonport.—Cinema and shops, Fore Street; Noved Cinema Co., Ltd.

Dumbartonshire.—Child welfare clinic, Helensburgh (£7,800), for the County Council; architect, County Council, Dumbarton.

Dundee.—Factory, for Solid Cedar Homes, Ltd., Hull.

Dunmow.—Houses (40), for R.D.C.; J. H. Nicholson, The Council House.

Durham.—Gymnasium, County girls' school (£6,050); T. B. Shilling.

Eastbourne.—Shops and flats, Langney Road; H. A. Thomas.

Ebbw Vale.—Cinema, James Street, for the Cornell Cinemas, Ltd., Ocean Chambers, Dumfries Place, Cardiff. House (186), U.D.C. surveyor.

Eire (PORTRUSH).—Cinema, Main Street, for W. L. James, Clooney Road, Derry. (CAVAN).—Cathedral for Diocese of Kilmore; Morris & Kavanagh, surveyors, 68, Harcourt Street, Dublin.

Enfield.—School buildings (£200,000), for the E.C.

Faversham.—Houses (42), Lower Road; borough surveyor.

Fraserburgh.—Houses (56), for T.C.; T. A. Swan, architect, Edinburgh.

Friern Barnet.—Flats (62); Lovesay & Son.

Gateshead.—School, near Old Durham Road; R. Burke, architect, Singleton House, Northumberland Road, Newcastle-on-Tyne.

Glasgow.—Houses (128), Deanston Drive, for Corporation; architect, housing department. Remand home (£50,000); Edinburgh Road, for Corporation; city architect. School, Frankfield Street (£20,000), for Corporation; Education department; architect, Education Offices, Bath Street.

Gloucester.—Cinema, St. Aldate Street, for the Associated British Cinemas, Ltd.

Hampshire.—Schools, Fairmile, Christchurch, Fareham, and Havant, also enlargement of County High school, Purbrook (£21,900), for the County E.C.

Horbury.—Houses (96), Dudfleet estate; U.D.C. surveyor.

Hornchurch.—Houses (47), Fulfield Road; Baker, Hammond & Laver, builders.

Huddersfield.—Houses (900), Dalton estate, for T.C. Houses (40); Abbey Dairy Co., Ltd.

Kent.—Hospital, Meopham, for the County Council.

King's Lynn.—Cinema, Pilot Street; K. C. Allflatt, architect.

Lancashire.—Relief offices, Huyton (£3,300), for the County Council.

Leatherhead.—Houses (63), Cleeves estate; U.D.C. surveyor.

Leicester.—Houses (1,064), near Blackbird Road and Beaumont Leys Lane; W. Parker, builder, Stocking Farm estate, Leicester. Improvements to Charnwood Street schools (£23,000) for the E.C.

Lincoln.—Houses (152), Monks Tower estate; city surveyor.

Liverpool.—Houses (226), Jeffries Crescent; Paramount Estates, Ltd., Mill estate, Roby. Houses (20), Swanside Road and Swanside Avenue; Davies & Williams, Pilch Lane, Huyton. Houses (20), Thingwall Hall Drive; Graylands Estates, Ltd., Huyton. Houses (30), and service roads; Bowring Park Building Estates, Ltd., Huyton. Out-patients' department, and other buildings, Walton Hospital (£39,059); borough surveyor.

London.—(BAYSWATER).—Cinema, Richmond Road and Westbourne Grove, for the Odeon Cinema Holdings, Ltd.; A. Mather, architect, Leicester Square Chambers, W.C.2. (BLOOMSBURY).—Rebuilding Birkbeck College, Malet Street, for the University of London; Adams, Holden & Pearson, architects, 25, Torrington Square, W.C.1. (HACKNEY).—Factory, Theydon Road, for Hunt and Partners, Ltd.; Sir E. Owen Williams, architect, 5, St. George's Road, S.W.1.

Lydney.—Houses, Lydney, Tidenham, and Woolaston; H. Russell, R.D.C. surveyor.

Manchester.—Factory, warehouse and garages, Wellington Place and Rice Street, for Hind, Hoyle and Light, Ltd., Rice Street; L. Ledger, architect, 40, Church Street, Urmston.

Margate.—Houses (58), Garlinge, for T.C.

Middlesbrough.—Houses (19), Westbourne Road, for J. Reubens; W. E. Haslock, architect, 143, Albert Road. Cinema, Acklam Road South, for N. King; Kitching and Co., architects, 21, Albert Road.

Morley.—Cinema, Queen Street, for London and Southern Super Cinemas.

Morpeth.—Offices; R.D.C. surveyor, Bridge Street.

Mostyn.—Factory for The British Oxygen Co., Ltd.

Newcastle-on-Tyne.—Houses (18), Bosworth Gardens, for A. C. Clark; Marshall, Tweedy and Bourn, architects, Grainger House, Blackett Street. Houses (12), Yewtree Gardens; W. W. Franklin, builder, Whinneyfield Road, Wallsend-on-Tyne. Flats (155) and shops, for C.C.; R. G. Roberts, 18, Cloth Market.

Newport.—Block of administrative offices, for the Civic Centre scheme; T. C. Howitt, architect, Exchange Buildings, East Nottingham.

Ongar.—Factory, Stapleford Abbots; Merton Bone Co., Ltd.

Plymouth.—Houses (18), Chesterfield Road; Fredco Estates, Ltd. Houses (116), Lopes Road, &c.; St. Aubyn Estates, Ltd. Houses (20), St. Gabriels Avenue; Hill & Lang. School, Montpelier; city architect. Extensions to Cattedown school (£14,263); Pearn Bros., Ltd.

Pontypridd.—Cinema, Taff Street, for the Cornell Cinema, Ltd., Ocean Chambers, Dumfries Place, Cardiff.

Rawtenstall.—School, Crawshawbooth, for the E.C.

Reading.—Aircraft factory, stores, &c., Reading Aerodrome; Phillips & Powis Aircraft, Ltd.

Rotherham.—School for physically defective children, East Bawtry Road; V. Turner, borough engineer.

Rugby.—Cinema, Hillmorton Paddox; Plaza Theatre (Rugby) Ltd.

Sheffield.—Extensions to factory, for Baldwin Electrical Co., Ellin Street.

Solihull.—Cinema, Warwick Street; Avion Cinema Co., Paradise Street, Birmingham.

Southwell (NOTTINGHAMSHIRE).—Houses, Caunton, Lowdham and Sutton-on-Trent; S. Cooper, R.D.C. surveyor.

Springwell.—School (£28,677); D. Glen, Jarrow.

Staffordshire.—School, Rough Hay, Darlaston, and alterations and additions to Salisbury Street and Slater Street schools, Darlaston; F. A. Hughes, director of education.

Stretford.—Houses (13), Urmston Lane; A. Wallwork. Clinic, Lostock (£6,499); H. Green & Son.

Sunderland.—Houses (48), Deepdene Road, &c.; W. Rutherford, builder, Sea Road. Houses (20), Humbledon Hill estate; E. and J. Purvis, builder, Garcia Terrace. Additions to library, museum and art gallery, for the T.C. (£41,000); C. A. Clayton Greene, architect, 1, Lenden Gardens.

Swanscombe.—Factory, Taunton Road; Kent Paper Sacks, Ltd.

Tottenham.—Extensions to factory, for The Caledonian Cabinet Co., 3, Market Road.

Tunbridge Wells.—Extensions to Kent and Sussex Hospital (£26,250); C. Burns, architect, Stone Lodge, Vale Avenue.

Walthamstow.—Civic centre, Forest Road (£239,738); borough engineer.

Warwick.—Houses (87), Saltisford Building estate; E. K. Youell & Son, Ltd., Weigh House, Walsgrave Road, Walsgrave-on-Sea, Coventry. Cinema, Market Hill; R. Satchwell, 6, New Street, Birmingham. Technical college, Nuneaton (£80,650), and extensions to High School for Girls, Sutton Coldfield (£19,500), for the County E.C. Rebuilding of St. Matthew's schools, Rugby (£20,000), and extensions to Murray school, Rugby (£13,000); county architect.

Wellington.—Houses (70), Arleston estate, for the U.D.C.; G. G. Kidwell, builders, Wellington.

Wembley.—Improvement of Wembley Stadium, for Wembley Stadium, Ltd. (£70,000), first section; Sir E. O. Williams, architect, 5, St. George's Road, London, S.W.1.

West Bromwich.—Houses (27), Jayshaw Avenue; Giles and Parker. Maternity hospital, Hallam Lane; borough engineer.

West Hartlepool.—School, Dyke House estate, for the T.C.; John Proud, Ltd., builders, 195, York Road.

Wolverhampton.—Factory, Church Street, for Windridges Prams, Ltd.

Wood Green.—Town hall; Sir John Brown and A. Henson, 117, Sloane Street, S.W.1.

Wordsley.—Houses (76), Kinver Street; A. & J. Mucklow, builders, Haden Cross, Old Hill, Staffordshire.

Worksop.—Houses (20), Carlton; surveyor.

Yorkshire.—Schools, Thornaby and Yam, for the North Riding E.C.